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Contents

PAGE

Editorials:
The Cost of Porphyry Developments.. 781
Haste in Development Work..... 782
Taxing Michigan Iron Mines..... 782
Business Progress..... 782
Metallics—By the Way..... 783
Duty on Byproducts of Smelting in Bond. *Washington Correspondence* 784
Tungsten in Montana..... 784
Broken Hill Proprietary..... 784
The Massachusetts Institute of Technology..... 784
Correspondence and Discussion: Abandonment of the Calumet & Hecla Merger....Standards for Mine Maps in Great Britain..... 785
Details of Practical Mining: *Holding Down the Cam Shaft on a Stamp Battery....Securing Loose Rock by Bolts....*Drafting Table for Rapid Tracing....*The Yeatman Classifier....*Water in the Air Line....*A Device for Making Wedges....*Rack for Drill Cores....Deep Sinking with Gasolene Hoists.... *Framing of Round Timbers..... 787
Meeting of American Institute. *San Francisco Correspondence* 791
Alaska-Treadwell Report..... 793
Sulphide Orebodies in Oxidized Zones. *Charles R. Keyes* 793
United States Lime Production..... 794
Cloth Pinions..... 794
*Porcupine after the Fire....*H. E. West* 795
Swastika Gold District..... 796
Note on Cadmium Determination..... 796
Mining Methods at Goldfield. *Claude T. Rice* 797
Electrolytic Antimony..... 801
Chromax, a New Alloy..... 801
*Scheme for Valuing Ore in a Stope. *Lee Fraser* 802
Washington Geological Survey..... 803
*First Aid to Mining Machinery—II. *Henry M. Lane* 804
Broken Hill South Silver..... 808
California Mineral Products in 1910.... 808
*The Cheever Mines, Port Henry, N. Y. *Guy C. Stoltz* 809
Slocan Star Mines, B. C.....*E. Jacobs* 812
Mineral Production of Quebec..... 812
New Publications..... 813
Personal, Obituary and Societies..... 814
Editorial Correspondence..... 815
Mining News..... 817
Markets..... 823

*Illustrated.

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The Cost of Porphyry Developments

As is well known, the development of certain deposits of low-grade copper ore, incorrectly referred to as "porphyry mines"—a misnomer in several cases that may, however, be retained for convenience—has been conducted on a scale of magnitude comparable only to that of the Calumet & Hecla, in Michigan, and has involved the expenditure of huge sums of money. It is of interest and value to summarize the expenditures of those concerns that have been brought to the productive stage and may be regarded as having passed out of the constructive stage. The following data are taken from the official reports of the respective companies and from private information:

Company	Mine Development	Mill Construction	Other Costs
Boston Cons.....	$1,072,489	$1,600,483	$ 474,848
Miami.....	1,200,000	1,300,000	2,000,000
Utah Copper Co....	1,189,659	4,402,769	820,071

Company	Annual Capacity, Tons of Ore	Total Cost
Boston Cons.....	990,000	$ 3,147,820
Miami.....	1,000,000	4,500,000
Nevada Cons.....	3,000,000	10,000,000
Utah Copper Co.....	4,000,000	6,412,499

Upon the face of things the Utah development appears to have cost about $1.60 per ton of annual capacity; the Boston Consolidated, about $3.20; the Nevada Consolidated, about $3.33; and the Miami, about $4.50. Before attempting to draw any conclusions from these figures, it is important to consider what they represent.

The Boston Consolidated, Utah Copper Company and Nevada Consolidated are steam-shovel mines, each with a mill, while the Nevada Consolidated has a smeltery in addition thereto. This smeltery has to treat about 250,000 tons of concentrates per annum and probably its capacity is in excess of 300,000 tons. Allowing $1,200,000 for this, the cost of the remainder of the plant is about $2.93 per ton.

In the light of the data available it is not easy to understand the low figure of the Utah Copper Company. To what this company puts down as its plant cost, we have added what it reports for dumping facilities, railway construction, etc. The great difference from the figures of the Boston Consolidated is to some extent explainable by the larger scale of operations, but this is far from accounting for all of it. The probability is that the "property account" of this company contains a great deal of the cost of mine development in addition to what is specifically reported as such, and color is lent to this belief when it is noticed that the Utah Copper Company reports only about the same amount on this account as do Boston and Miami for far less tonnages and capacities. We do not feel that the $1.60 figure of Utah Copper should be taken too seriously.

Looking at the concentrating mills only, that of the Boston Consolidated cost about $1.60 per ton; Utah Copper Company, $1.37; and Miami, $1.30. The Boston mill has no power plant and the Miami figure is exclusive of the power plant, which serves both mine and mill. Estimating that it will use about 3000 h.p., of which the first cost is about $300,000, the total milling cost is about $1.60, which does not compare unfavorably with that of the Utah Copper Company, considering the smaller size and the more elaborate construction.

The relatively large capital outlay at Miami, aside from its mine development and mill construction, both of which were extraordinarily well done, is explainable chiefly by the facts that this is an underground mine, requiring costly hoisting plant and accessories, and that its mill is situated right at the mine, involving a large outlay for waterworks. In the cases of the other porphyry mines the mills are situated nearer to water supply and the ore is transported to them by railway, whereby the mining companies escape first cost of plant at the expense of additional cost of operation later on.

In the cases of all of the porphyry mines, except the Boston Consolidated,

the estimates of their engineers as to plant capacity have been greatly outdone, and in some cases the installation of plant has been such that further increase in capacity has been gained at relatively slight expense. In taking the figures of capacity as the divisors, we have used the latest authenticated estimates. Perhaps the quotients available are too few to permit a thoroughly reliable deduction. Insofar as they go, however, they seem to indicate that the development and equipment of a porphyry mine, to be operated by steam shovels, without smelting facilities, is likely to cost from $3 to $3.50 per ton of annual capacity, while an underground enterprise, of the nature of the Miami, is likely to cost from $3.50 to $4.50. In plants of these huge capacities, variations in size do not result in so large differences in the cost per ton as they do in the case of smaller plants. Of course, there is always likely to be a variation among the costs of plants of the same capacity. In this connection, it is to be borne in mind that there is a very direct relation between first cost of plant, percentage of mineral extraction and operating cost.

Haste in Development Work

In the JOURNAL of Oct. 14, the effects of neglecting to develop ore reserves in proportion to the rapidity of extraction were discussed by Benjamin B. Lawrence in an article entitled "A Point of View on Ore Reserves." Several years ago H. C. Hoover aroused considerable discussion in advocating the rapid exhaustion of the ore in a mine on the grounds that the more quickly the ore was mined the greater would be the profits. His remarks were undoubtedly true for such deposits as the Rand "banket reefs," which have deservedly been compared to the regularity and persistency of coal measures, but for the irregular orebodies, which are far more numerous, and of which the Goldfield and Cripple Creek deposited are examples, too rapid exhaustion of the ore is often synonymous with the haste that makes waste.

Too many mines come into the limelight for a brief period, then dwindle into obscure properties in which miners work under a lease, often making "strikes" that were missed by the original operators by too rapid development at the cost of thoroughness. Mr. Lawrence emphasizes this point of following up minor "indications" and local features, which if thoroughly investigated are often the means of leading to valuable stringers of ore the presence of which could only have been otherwise discovered by accident.

Development work should not consist in the mere blocking out of ore, but in the search for new deposits, or the faulted branches of those already known. It is the history of many a mine that extraction has followed so closely upon development that a fault suddenly discovered and by which the vein had been much displaced, has caused such a protracted delay that funds were exhausted before the faulted vein could be found.

Taxing Michigan Iron Mines

The long discussed and much vexed question of the assessment of mining property for taxation has been up again, this time in Michigan. That State, as our readers know, took the unusual step of employing an expert to value its mines, and Mr. Finlay's report has been published and extensively discussed. The question of valuation came up for final settlement before the State Board of Assessors last week, and that body finally settled on valuations of the iron mines, which reached a total of $85,000,000 in round figuring, this being $34,500,000 below the expert's valuation, but over $65,000,000 above that made by the local assessors.

The Finlay report to the State Tax Commission gave an estimate of value $100,000,000 above that at which the State had previously rated them for taxation. Such an increase was certain to cause protest from mineowners, and the latter were given an opportunity before the final decision was reached to present their reasons for protest at a public hearing in the iron country not long since. While the majority of iron-mining companies were represented by men who stated their company's views, by far the most interesting and instructive address was that given by W. G. Mather, president of the Cleveland Cliffs Iron Company, one of the largest operating companies in that region.

Whether or not the State of Michigan has correctly taxed these properties we will not discuss here; but W. G. Mather is a practical iron man, long identified with that business in upper Michigan, and voluminous addresses from men of his caliber regarding the business in which they are engaged are rare enough to merit attention. Mr. Mather brings out two salient points, among others, to which he objected in Mr. Finlay's report. As one, it is claimed that the report took no account of the extra cost which would be inflicted upon the mines by the increase in the taxation. While at first this may not appear to be of importance, in reality it is a good-sized item in the case of several companies. The second point is taken that the valuation is based on an interest return of 5 per cent., whereas it was contended that 10 per cent. was not too high a return to expect, when the risks of the venture are all taken into consideration. Mr. Mather also suggested that the commission would have been aided somewhat if it had had the assistance of a financier, or a man who was accustomed to sell bonds or to finance a property.

Whether Mr. Mather's points were well taken or not, it is well to bear in mind that the true market value of many a property is really dependent less upon the quantity and quality of ore contained therein, than upon simple and often overlooked commercial conditions, such as freight rates, metal-market conditions and borrowing rates for money. This is especially the case with an iron-ore deposit, where the bulk of the product is large compared with its value.

Business Progress

Perhaps the most noteworthy event of the week was the Federal court decision against the General Electric Company, holding that the electric-light combination, of which it formed a part, was contrary to the law and must be broken up.

An attempt was made late in the week to revive the rumors of a Government suit against the Steel Corporation. This was met by a prompt denial from Washington; no proceedings have been begun or are expected at the present time.

Political conditions in Europe have brought about higher interest rates, and a demand for money which seems likely to call for exports of gold from New York at an early date.

Business generally, especially in the iron and steel trades, has been gradually extending. The effect of the open market, as contrasted with controlled prices, has been notable in recent weeks.

Metallics

An average of 36.6 per cent. of the quicksilver used in the stamp mills of the Alaska-Treadwell company is lost.

At the Globe & Phœnix mine, in Rhodesia, Edwards furnaces are to be used for roasting the accumulation of antimonial tailings. The roasted material will be slimed and treated in a continuous-decantation cyanide plant.

In some of the largest copper mines of Lake Superior, incline shafts are used and rectangular skips of from seven to 10 tons capacity are employed in hoisting ore. These skips are so deep as to require a ladder in many cases to enable a man to climb out.

Mildewing of canvas can be prevented by applying the following composition: Sugar of lead, powdered, 3 lb.; water, 15 gal.; dissolve thoroughly and take of powdered alum 4 lb.; water, 15 gal. Dissolve the alum and mix the two solutions thoroughly in a clean barrel or other suitable container and immerse the canvas, keeping it under the surface of the fluid for 12 to 24 hrs. Then hang up to dry without wringing. The white powder (sulphate of lead) will shake off for a few days afterward.

To write on blueprints in white, several methods are commonly employed: Use commercial white ink; make a solution of "Chinese white" in water to the desired consistency; or use a bleach consisting of a solution of soda. Ammonia water can also be used, but is too thin to work well and the soda solution is generally the most satisfactory. The practice at some places is to add a few drops of bright red drawing ink to this solution, which will make pink marks and lines on the blueprint, and will show plainly that changes or additions have been made to the print, which is sometimes an advantage. To bleach a brown negative print, a solution of bichromate of mercury or corrosive sublimate works well. The strength of the solution to be used will vary with the intensity of the print.

The following scheme was tried as a safety device in a Lake Superior copper mine: In addition to a timber pentice placed below the bottom hoisting level, one end of a heavy, well-greased plank was placed against each skip rail, the other end resting against the hanging wall, the object being to deflect a runaway skip into the hanging. Soon after its installation, an accident tested its usefulness. The skip apparently had been deflected somewhat, but the momentum was so great that the planks had broken through and the skip demolished the pentice as though the latter had been made of pasteboard. While it is possible that iron rails might have withstood the shock, undoubtedly a rock pentice is still the safest plan.

By the Way

During the next five years the small manufacturer who is swept out of existence will often wonder why, wrote Professor Duncan in his "Chemistry of Commerce." He will ascribe it to the economy of large scale operations, or business intrigues or what not, never knowing that his disaster was due to the application of pure science that the trust organizations and large manufacturers are already beginning to appreciate.

The following record of the Ahmeek mine in the Lake Superior copper country is noteworthy. The company has 50,000 shares, par value $5, on which $17 have been paid in. The last call of $5 was paid in 1904 and amounted to $250,000. This, with possibly a small balance left over from previous unsuccessful efforts on another lode, constituted the working capital. Since then four shafts have been sunk, two of which are over 1500 ft. deep, and well supplied with lateral openings, the remaining two shafts being about 1000 ft. deep each and comparatively new. Surface installations are complete and modern at the two former shafts and a stamp mill has been constructed at a cost of several hundred thousand dollars; in addition a substantial dividend has recently been declared. Mine operations have paid for all this, and at present there is a credit balance of about $800,000; the ore averages less than 1½ per cent.

A magazine, calling itself *Financial Converse* and published every two months in Chicago, is according to its own frank statement based on new financial lines—which seem to be largely the selling of shares in a property "near" the Ray Consolidated, as this is the only advertisement that the "magazine" carries. The copper property in question appears to have the advantage over most others in that the managers are using the "electric Terreohmeter" to find ore zones. We do not know that there are any regulations or restrictions about the manner of prospecting for ore—now, that the Government agents have settled with the Stauffers who controlled the "Goldometer" and other special devices of this character—but it seems hardly fair to the Copper Producers Association to turn anyone loose on 538 acres in the "greatest copper zone in the world" with an electric Terreohmeter which is said to "locate orebodies by the measurement of the resistance in ohms of electric current passing through the earth's crust from point to point." In addition to the possession of such an open sesame to the riches of the earth, there is great assurance, according to the president, in the "predictions of mining engineers of the highest order." This should be comforting to prospective shareholders, as there are only a few engineers of such elevated standing here now—most of them are in heaven, where they are doubtless busy reporting on the paving. However, it is not to be assumed that this property has not had its troubles, for we read in the Sept. 15 bulletin that on the 170-ft. level "the drift south to crosscut the four most northerly veins, had 120 ft. more to go to reach the first vein when it ran into a quartz dike that was as hard as flint. This quartz dike," according to the bulletin, "indicates very strong values in the veins because they are probably intact from the wash of surface waters; but the 20-h.p. boiler was unable to carry the drills through this hard rock." A 40-h.p. boiler has now been installed and the fiscal agents will hold financial converse with you at 60c. per share, until the first vein is passed through, after which, of course, the price will be skyrocketed.

An interesting feature in connection with the celebration of Cardinal Gibbons' golden jubilee at Baltimore recently was the presentation of a rosary of gold nuggets, the gift of the Knights of Columbus. The rough cross and the beads of the rosary are stated to have been made from nuggets taken from a placer mine in Alaska. The rosary was originally the gift of a miner to Sister Mary Clare, of St. Johns, N. F., in return for a kindness she had rendered. Sister Clare, who is engaged in work among the poor fishermen's daughters of St. Johns, did not feel that a humble follower of the religious life should keep such a valuable rosary. Then funds were needed for completing the institution for work among the girls of St. Johns. The Knights of Columbus felt that no better gift could be given to the Cardinal than this rosary of such unusual design, so they gave a large sum to the sisters' work and got the rosary to give to the Cardinal.

Emanuel S. Mendels, who has for several years been practically the head of the Curb market in New York, died on Oct. 16, after an illness of three weeks. Mr. Mendels began business as a curb broker 37 years ago. When the Curb organization was loose, he was the interpreter of the unwritten code which controlled the Curb brokers. Later, he was the agent or head of the semi-formal organization. When efforts were made in 1907 to compel General Bingham, then police commissioner, to close the Curb market, Mr. Mendels did yeoman service in its defense. Last winter he was active in the proposed reorganization of the market and when the New York Curb Market Association became an accomplished fact, in the spring, he was made its secretary, and was also a member of the board of governors. While the Curb market still leaves much to be desired in some of its methods, much of its present substantial character is due to Mr. Mendels' efforts.

Duty on Byproducts of Smelting in Bond

WASHINGTON CORRESPONDENCE

The United States Court of Customs in an important decision handed down on Oct. 12, has reversed the finding of the Board of General Appraisers in the American Smelting and Refining Company, appellant, vs. the United States, appellee. The case involved certain lead bullion imported at the port of Perth Amboy, N. J., and subsequently smelted and refined under bond. A lead product resulting from the smelting and refining was withdrawn for domestic consumption and was assessed for duty by the collector of customs as lead bullion, at 2⅛c. per lb., under the provisions of paragraph 182, as provided in section 24 of the Tariff Act of August 3, 1909.

The American Smelting and Refining Company, which imported and refined the lead bullion, protested that the product resulting from the refining of said bullion was not lead bullion but type metal, and that, therefore, in accordance with the provisions of section 24, it was dutiable 1½c. per lb. on the lead contained therein, as provided by paragraph 191. The Board of General Appraisers overruled the protest and the importers appealed.

From the report of the collector of customs, the testimony in the case, and the findings of the board, it appears that the importation was one of crude metal in the form of lead bullion which had been roughly smelted at Monterey, Mexico, and shipped from Tampico, Mexico, to the United States. On arrival at destination the lead bullion was removed to the bonded smelting warehouse of the importers without the payment of duties and there subjected to a refining process which, as found by the board, extracted therefrom the precious metals and a percentage of refined lead, leaving a residuum or byproduct, of which, on the average, 81 per cent. was lead, 17 per cent. antimony, and 2 per cent. other substances, such as arsenic, copper and silver. This residuum or byproduct was withdrawn for domestic consumption, and is the article which the collector classified as antimonial lead, dutiable at 2⅛c. per lb., under paragraph 182, by reason of the provision of section 24, and which the board decided was dutiable as lead bullion at the same rate under the same paragraph and section.

On this state of facts there was but one question presented by this appeal, and that was: What construction should be put upon section 24, and particularly upon that part of it dealing with lead withdrawn for domestic consumption?

The court held, after going carefully into the question, that the material was not lead, antimonial lead, nor lead bullion, but that it was type metal, as claimed by the company. In conclusion the opinion says: "Section 23 provides that byproducts incident to the processes of manufacture in bonded manufacturing warehouses may be withdrawn for domestic consumption upon the payment of a duty equal to the duty which would be assessed and collected, by law, if such byproducts were imported from a foreign country. It seems to us that the second proviso of section 24 had a similar purpose in view, and that it was designed and intended by Congress to put lead products resulting from the smelting or refining of ores of crude metals in bonded smelting warehouses in the same position with respect to duty as byproducts of bonded manufacturing warehouses and in no worse position than imported materials of the same kind. Certainly it would be anomalous that the byproduct of a bonded smelting warehouse should be made dutiable on a basis different from that fixed for byproducts of bonded manufacturing warehouses."

Tungsten in Montana

A discovery of tungsten ore was recently made near Pony, Mont. A letter from Charles E. Morris gives the following description of the deposits.

The deposits are situated in the Potosi mining district, an abandoned silver camp which lies in an air line about seven miles southwest of Pony, Madison county, Mont. The district is about 11 miles by wagon road which passes Potosi hot springs. The tungsten ore occurs in aplite dikes which are a part of a large igneous intrusion extending along the eastern slope of the Tobacco Root range of the Rocky mountains. The ore occurs in distinct veins from one to 12 ft. in width. The elevation is 8000 ft. above sea level.

The tungsten occurs in white quartz in long brownish needle-like crystals of hübnerite ($MnWO_4$). Specimen samples which have not shown a large proportion of the crystalline mineral have given encouraging results by analysis. This seems to furnish evidence of the presence of tungstic acid in addition to hübnerite. The district is near railroad facilities which will be an advantage in the development of the camp should the deposits prove of economic value.

Broken Hill Proprietary

In the half year ended May 31, 1911, the Broken Hill Proprietary Company paid its one hundred and fifty-fifth dividend, making a total cash and share distribution of 3031 per cent. in 26 years. Underground operations were resumed on Feb. 16, 1911, and the weekly output is being brought up to 5000 tons.

During the half year 52,441 tons of ore were treated, producing 10,638 tons of lead concentrates assaying 57.43 per cent. lead and 27.08 oz. silver, and 7980 tons of slimes assaying 13.20 per cent. lead and 16.47 oz. silver. The new mill treated 159,609 tons of old tailings, producing 5090 tons of lead concentrates and 10,737 tons of slimes. The tailings from both plants were sent to the zinc concentrator and produced 44,110 tons of concentrates, assaying 44.88 per cent. zinc, 6.95 per cent. lead; and 12.86 oz. silver.

During the year 1828 tons of slimes were sent to the sintering plant, for preparation for the smelters, but sintering operations are being curtailed, as the zinc is lost in them, while it is found possible to save it by flotation. Chamber acid to the amount of 2686 tons was produced, of which 361 tons were sold to other companies.

At the smeltery the mechanical charging installation was completed, and Dwight-Lloyd roasters are being installed. The spelter plant has been started, producing 665 tons of spelter and 100 tons of blue powder, and all difficulties, including the manufacture of the retorts, have been overcome. The mechanical roasters are almost completed, after which production will be largely increased.

The Massachuetts Institute of Technology

The trustees of the Massachusetts Institute of Technology have practically settled the question of the site for the new buildings by taking options on a large area of land in Cambridge, fronting on the Charles River basin. These options depend upon the action of the Cambridge city council in closing two or three streets now laid out across the property, but there is no doubt that such action will be taken, so that the matter may be considered as closed. The tract includes about 50 acres, with a water front of nearly one-third of a mile. It is nearly level and is most convenient of access.

The trustees believe that the choice of this land for the site for the new Tech will meet with the approval of the student body and alumni, as well as the general public. It possesses many advantages over any other site under consideration. As affording an opportunity to make the new buildings, which are expected to be of noteworthy architectural design, a fitting setting, the land on the bank of the Charles River basin is most desirable. Furthermore, the development of this property by the Institute will greatly enhance the beauty of the basin's surroundings. Tentative plans for the new buildings are already being worked out.

The production of barytes, barium sulphate, in the United States in 1910, according to E. F. Burchard, of the U. S. Geological Survey, was 42,975 tons, valued at $121,746, a considerable decrease as compared with 1909. The greater part of the mineral produced is consumed in the manufacture of mixed paints.

Correspondence and Discussion

Abandonment of the Calumet & Hecla Merger

In addition to what has already been written in the editorial in the JOURNAL of Oct. 14, regarding the outcome of the attempt to consolidate some of the Lake Superior copper mines, it might be stated that not only could economies have been effected through the fact that certain mines could be more profitably worked through the shaft of a neighbor—resulting, it has been estimated by some, in the elimination of probably 10 per cent. of these shafts, some of which are unusually close together when the depth of the mines is considered—and not only would further economies have resulted from the more efficient management that has characterized the Calumet & Hecla operations, but the merger would also have had certain advantages for the copper country as a whole.

The miners, for example, would have been in the employ of a company which has from its beginning exercised a solicitude for the welfare of its workmen. It is, perhaps, the only company that watches over its blind miners and provides them with work—in this case, broom making—so that they retain their self-respect through being self-supporting and not becoming a drain on their relations or friends, as is so often the fate of the blinded miner. This company also conducts a pension and aid fund for its employees on far more generous terms than most other mining companies.

The Lake Superior district is unlike most other American mining areas, and resembles the Rand in one respect that prospecting is by the nature of the ore occurrence expensive and consumes a long period of time. Even if ore be found, its grade can only be guessed until a large tonnage has been sent to the stamps and the copper extracted. Long, expensive campaigns of prospecting do not appeal to the ordinary speculator in mining prospects, who usually prefers prospecting in the Western country where $10,000 will show as much in regard to the future of a prospect as $100,000 in the Lake district.

The Lake Superior district must, therefore, be prospected with money coming from those well acquainted with its possibilities. Heretofore the prospecting has been mainly on the assessment basis, and the prospecting of the area has accordingly dragged.

Such methods of prospecting can flourish only when there is general prosperity throughout the country and at times when new discoveries have attracted attention to that part of the country. Money is

Views, Suggestions and Experiences of Readers

easily obtained for the treasury at those periods, but if ore be not found before that is exhausted, prospecting will languish until another spasm of interest in the possibilities of the district becomes general. During the time between these spasms the shares are booted around the exchange, serving merely as numbers on the mining roulette wheel, mainly attractive to the venturesome, who in time become the victims of the market riggers in those stocks, much to the discomfiture of the district and greatly to the detriment of mining in general.

T. S. C.

New York, Oct. 15, 1911.

Standards for Mine Maps in Great Britain

It has for a long time been recognized that much yet needs to be done in order to bring to perfection the system of making plans from mine surveys. As long ago as 1882 S. F. Sopwith advocated certain reforms in the system of mine surveying which, although sound and practical, have not yet been carried into effect, while the late Bennett H. Brough, the well known instructor in the Royal School of Mines, at South Kensington, has included many suggestions in his book on mine surveying which are worthy of the closest attention. It is with the object of enforcing and in some cases developing the ideas expressed by such men that the following notes have been written. Possibly in some respects they may be somewhat controversial, but as nothing can be lost by discussing such an important subject as the survey of metalliferous mines, I will take disagreement with my conclusions to be as valuable as agreement, provided that cogent arguments are advanced.

PLOTTING MAPS TO TRUE MERIDIAN ADVOCATED

One of the most important reforms which needs to be carried into effect is some system of coördination of one set of mine plans with another. At the present date too many mine plans are plotted in relation to their individual magnetic meridians, and it requires little argument to show that this system is open to the gravest objection. In applying this method to accurate record, one has not only to contend with the fact that the declination of the magnetic needle varies from the true north year by year, and even week by week, but also with the disadvantage that, owing to imperfect construction, different dials used in instruments have different variations. Evidently, then, in a mine plan which has been in use for several years and which in every probability has been kept up to date by different surveyors, errors can hardly fail to occur. The effect of this will in every probability be not merely miscalculation and pecuniary loss to the owners of the mine, but serious and even fatal accidents may easily occur from such a cause.

As has already been pointed out by Mr. Brough in his book, Mr. Sopwith long ago recommended that the prosperity of mining districts would be increased if meridian lines were carefully set out at distances of one mile apart, thus dividing the country into squares of one mile each for purposes of reference. It does not seem altogether an impossible idea in areas where mining forms a prominent industry that either a national or local authority should erect stone or other suitable posts in pairs in the line of the true meridian and that all mine plans should be compulsorily plotted to that true meridian. The mine surveyors would then at all times be easily able to obtain the magnetic variation of their instruments and to plot their work to the true meridian without difficulty. Indeed, I think that as the areas become more congested, and the workings of adjacent properties approach close to one another, such a system will be recognized as a necessity. The counsel of perfection in one generation becomes a commonplace in the next.

DATUM LEVELS FOR UNDERGROUND WORK

Another point which has been discussed by the writers above mentioned, and which stands in natural correlation with the one just discussed is the subject of levels. T. A. Ramsay, before the North of England Institute of Mining Engineers, a long time ago suggested that the Ordnance levels on which surface surveys are founded should be continued into the underground workings. The advantages which such a system would have over the present can easily be seen. At present, in metalliferous mines, each mine takes its own depths either from the collar of its own shaft or from its own adit. Such a point of reference is entirely arbitrary, with the result that there is no coördination between it and neighboring mines, and there is little chance of determining

from plan readings the relative positions, as regards depth, of neighboring workings. This system or rather lack of system, leads not only to confusion, pecuniary loss, and sometimes fatal accidents, but retards the progress of scientific mining in its broadest aspect to a deplorable extent.

The idea enunciated by Mr. Ramsay, and others, would be of great value in this respect. The Ordnance benchmarks, which are now to be found in the neighborhood of every mine in England and even on the engine houses themselves, should be carried underground and should be permanently fixed in every station in all shafts. Where the workings are below Ordnance datum, which in Great Britain is the approximate mean-tide level at Liverpool, the benchmarks could, with advantage be inverted, and the hights of such benchmarks should, together with the marks themselves, be inserted plainly on the plan. It can fairly be argued that not until some such system is adopted can mining as a whole be properly and effectively conducted, while the saving to individual mines in the ease and rapidity with which any desired section could be made at any time would be considerable. The plans, thus figured, would give, not only the relative positions of the different levels, but also at a glance their relative perpendicular distances, which latter can now only be obtained by laborious reference to and careful measurements of the section. Moreover, it must not be forgotten that such sections, for want of the necessary permanent underground benchmarks and the checks afforded thereby, are seldom more than approximately correct.

The Use of Conventional Signs

There is much to be said in favor of a stricter adherence to the use of conventional signs. The mine plans which I have handled from time to time in the course of my professional experience have ranged from definitely tinted and marked plans in which not only the different levels are systematically colored, as should always be the case, but the levels are shown at their full width. Other plans presented a confused appearance, and only by a great stretch of imagination could they be conceived to be of much practical use. Their main purpose appeared to be to keep the management within the technicalities of the law relating to metalliferous mines in Great Britain, which is by no means so exacting as it might be.

For many reasons it is highly desirable that all levels should be shown at their full width, and the standard tinting of the various levels should be adhered to. The adit levels, for example, should be colored blue; all other levels in the same lode should be colored with Hooker's No. 2 green; levels on a different lode should be colored with burnt sienna; all crosscuts should be shown by a gamboge wash, while all shafts, raises and winzes should be colored in crimson lake. In addition, to whatever scale the plan is drawn, the representative fraction would be clearly marked upon it. In this way the mine plan becomes a real asset instead of being an unintelligible or confusing muddle.

Standards of Scale

Carrying the conception of coördination and standardization a stage further, it is obviously desirable from every point of view, that there should be uniformity of scale for the construction of mine plans. The German mines are subject to imperial law in this respect, and mine plans have to be scaled in conformity with government regulations. In France and Belgium the scale of 1: 1000 is imposed by law for all mine plans, and it is curious to find that in some other countries, as for example, Great Britain, the utmost laxity prevails on this most important point. For instance, in the great metal-mining center of Cornwall, the scales at present in use are 4, 5, 8 and 10 fathoms per inch or expressed by their representative ratios, the scales are 1:288, 1: 360, 1: 576 and 1: 720. The confusion caused by this multiplicity of scales, all in use at the same time in one small area, is still worse confounded by the fact that the Ordnance maps of the government surface survey are on a scale of 1:2500. It is evident that unquestionably all mine plans should be laid down to some multiple part of such a scale, and nothing could be more suitable than a scale of 1: 500, which is the scale imposed by the German government for metalliferous mines. This figure would be rendered still more convenient, at any rate in Great Britain, by the fact that in the case of all towns in the United Kingdom having over 4000 inhabitants, the Ordnance survey has already mapped the area covered by them on a scale of 1: 500. For example, the towns of Camborne and Redruth, situated in the most productive mining area of Cornwall, are already mapped by the government on a 1:500-scale, and there are many cases where the Ordnance town maps could be used for checking surface measurements, etc., on the plans of the neighboring mines.

The fine old conservatism of the average mine agent may be urged as an objection. It has been argued that these men are accustomed to use the 2-ft. rule in taking measurements from a plan and that therefore the abolition of the 4- and 8-fathom scales would plunge them into confusion. Apart from the fact that this is setting a low value on their ability, it may be pointed out that the same objection may be with equal force urged against the 5- and 10-fathom scales now in use; but the objection has never been raised.

Maps to 1: 500 Scale Recommended

A little investigation of the point may be desirable. By a 1: 500 scale is, of course, understood that one inch (or other unit of length) on the plan represents 500 in., or other similar units of length in reality. Now 500 in. equal 41.66 ft., or 6.943 fathoms, so that with a scale of 1: 500, one inch may for all practical purposes be taken as seven fathoms. Instead of the use on the plan by the mine agents of a 2-ft. rule, often from the nature of circumstances covered with tallow and dirt, a box-wood scale of 1: 500 at least two feet in length should be kept hung up for use with the plan. Where mine plans are drawn on a scale of 1:500, every measurement at surface would, of course, be five times the length of the same measurement on the Ordnance plans of 1: 2500, and hence great facilities would be afforded for checking the work, filling in surface details and so on. Conversely, the reduction of all underground workings from 1: 500 to 1: 2500 could be readily accomplished, such workings being then transferred to the Ordnance maps together with the underground benchmarks to which reference has been made. Correct information would then be available as to the lodes of any mining district, not only as to direction but also to underlie, and the exact depth to which proof has been effected.

The use of such plans as those described in these notes would be in my opinion, invaluable. The abolition of the fathom in mining is much to be desired, in favor of giving hights and distances in feet and decimals thereof. There might be no objection to the introduction of the long fathom of 10 ft. just as in the United States and Canada the convenient short ton of 2000 lb. has been adopted. Finally, if instead of leaving mine plans lying about to be spoiled by the effects of dampness and dirt, there were provided at all mines tin cases for the plans in which they were to be stored, there would be greater possibility of accurate plottings of subsequent surveying, and any alteration of management involving local knowledge would not be so acutely felt. In making the above observations I have based my deductions on conditions as they at present exist in one of the important metal-mining centers of Great Britain. It may surely be said, however, that the same arguments apply, with greater or less force as affected by local conditions, to all the metal-mining areas of the world. For this reason, it is hoped that the suggestions herein introduced will not be without interest to mining engineers and surveyors wherever they may be.

H. G. Henderson.
Truro, Cornwall, Sept. 8, 1911.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

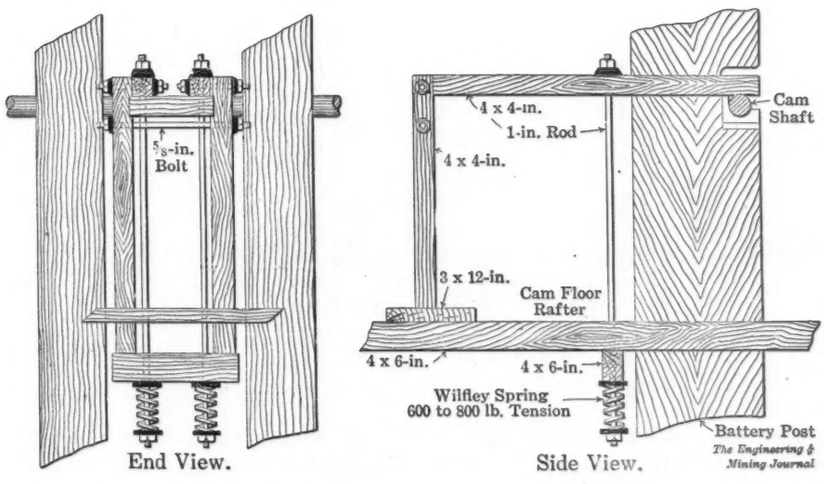
Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

Holding Down the Cam Shaft on a Stamp Battery

BY CLAUDE T. RICE

It has been found practically useless to try to hold down the cam shaft of a stamp battery by means of caps on the boxes. As a consequence, it is the general practice to use the boxes without caps. This allows much vibration that is hard on the cam-shaft bearings. The babbitt of the bearings wears away quickly under the continual hammering, and has to be renewed frequently. To avoid the delay and expense of rebabbitting so often, soft-iron cam-shaft bearings are sometimes used which are not babbitted; the bearing is replaced when it is worn out.

The following method of damping the vibration of the cam shaft in its bearings is used at the Montana-Tonopah mill with great success, and it is said to have proved equally efficient at the Goldfield Consolidated mill. It is illustrated in the accompanying sketch. In this method a 4x4-in. piece of wood is pressed down on the top of the cam shaft by means of a spring from a Wilfley table, as this is the spring that can most easily be obtained in a mining camp. It is strong enough to give the desired tension, and of good enough quality to resist the strain of the constant vibration. It is placed on a 1-in. rod and tightened so that there is a stress of from 600 to 800 lb., if not more, downward on the top of the cam shaft.



CAM-SHAFT DAMPING DEVICE AT MONTANA-TONOPAH MILL

The top end of the rod that projects through the restraining beam is fitted with a nut, so that by taking off this nut on the holding-down bolt, and by removing the bolt that fastens the other end of the beam to the saddle device, supporting the other end, and which acts as a fulcrum for the holding-down lever, this beam can be easily taken off, and so it is not in the way when it becomes necessary to work on the cam shaft. These damping devices are placed over each bearing of the cam shaft of each battery, and as great pressure as possible obtained, so as to damp the vibration of the cam shaft effectively.

At the Montana-Tonopah mill, before this device was installed, the cam shaft bearings had to be rebabbitted every six to nine weeks, as the vibration rapidly chipped out the babbitt metal. Now the shaft has been running for four months with a holding-down spring device, without a single bearing having to be rebabbitted. How much longer the babbitt metal in the bearing will last is difficult to say, as the metal shows little, if any, sign of chipping.

At the Tonopah-Belmont the same result is effected by means of a railroad car spring footed against a shoulder cut in the battery post, and pressing an oak block 12 in. long against the cam shaft. This method of damping the vibration is also found quite effective, and seems to be somewhat simpler, although railroad car springs would have to be specially ordered at most mines.

Securing Loose Rock by Bolts

In the Camp Bird mine the wall rock is quite hard and in most cases stands well, but in the driving of the main raise extending from the haulage level to the upper workings, through which supplies and men are hoisted, several large slabs of rock began to loosen after the timbering of the raise was well under way. Cracks began to open behind these slabs which would have come down in pieces weighing several tons had it been necessary to blast them. As this could not be done without considerable danger to the timber in the raise, the slabs were bolted in place in the following manner:

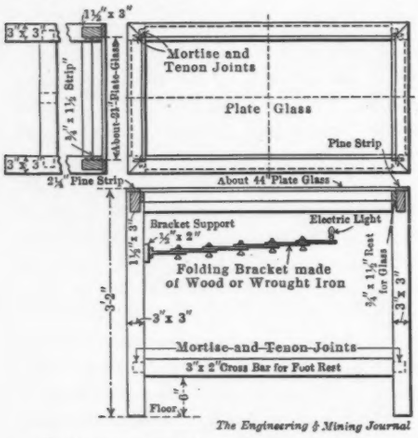
A slab was securely spragged in place by temporary stulls running across the raise, so that it could not move or at least without giving ample warning. Single-jack holes were drilled through the slabs, which were themselves quite solid, and into the solid ground behind them for a distance of a foot or more. Then the depth of the hole was measured, and an old piece of drill steel, with its head well upset so as to form a strong head like that of a bolt, was cut off to the right length and the lower end split. A narrow steel wedge was then inserted in the split end, which was pushed into the hole, wedge-end first, until the wedge was against the bottom; then, by hammering, the split ends of the drill were spread until the bolt was securely anchored in the wall rock behind the slab of ground, thus holding the slab tightly in place. The sprags were then removed.

These slabs had been held by bolts seven or eight years when my attention

was called to them. Apparently they had not moved a fraction of an inch since they were bolted to the wall behind them. Several bolts were used in each slab, placed according to the direction of the crack behind them. The method of securing the bolts in the wall rock is, of course, the same as that of anchoring bolts in concrete when for any reason new bolts have to be used in old foundations.

Drafting Table for Rapid Tracing

An inexpensive table, especially adapted for making tracings from indistinct pencil sketches, for copying from old blueprints, or for reproducing on ordinary linen paper from tracings, etc., is shown in the accompanying drawing from *Shop Notes Quarterly*. As many lamps may be used as required, but care should be taken to keep them a sufficient distance from the glass to prevent it from becoming heated, and thus causing wrinkles in the cloth. The bracket shown under the table may be placed in any desired position by releasing and tightening the thumb screws and adjusting the supporting strips.



TRANSPARENT-TOP DRAFTING TABLE

In making a tracing the drawing or print from which the copy is to be made should be placed next to the glass and fastened down to the pine strips with thumb tacks. Over this should be placed the tracing cloth, and this should be fastened down in exactly the same manner as would be done on an ordinary drawing board.

Tracings can be rapidly made on this table, as there should be just sufficient warmth from the light to dry the ink almost as quickly as it is put on. The table should prove exceptionally useful to all who have to make tracings from time to time, as a saver of both time and eyesight. A number of tables of this type have recently been described in various technical papers, but this one has the advantage of simplicity in construction and design.

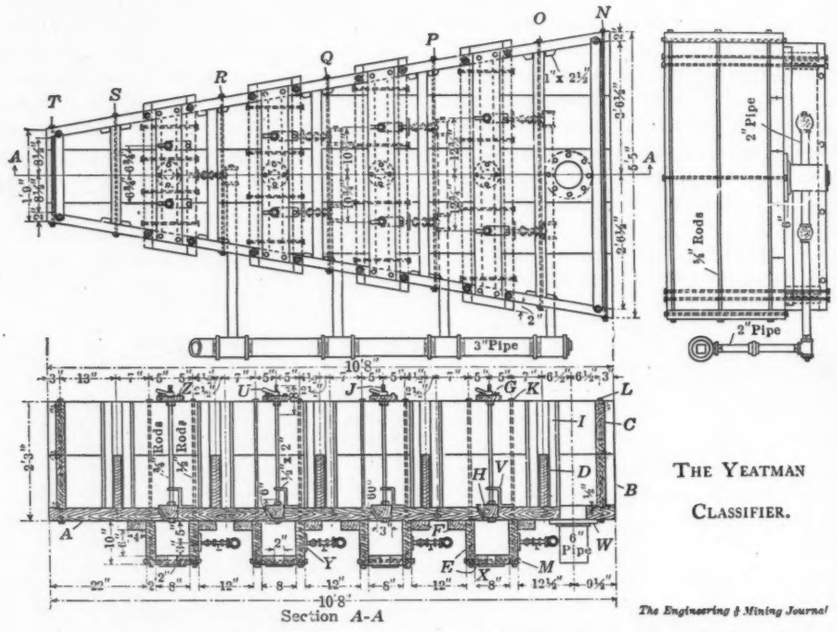
The Steptoe Distributer

At the Steptoe concentrator at Ely, Nev., a distributer somewhat similar to those installed at Ohio Copper mill but much simpler is used. The distributer consists of a cylindrical box 30 in. diameter and 30 in. high, on the top of which are mounted the shafting and bevel gearing that drive four paddle arms, fastened to a vertical shaft, that revolves at a speed of about 15 r.p.m. On the side that the feed launder enters, a baffle board is used to keep the feed from striking the upper part of the vertical shaft and from being splashed about the mill. In the sides of the cylindrical box are fitted bushings about 3 in. diameter through which the pulp is discharged, while about eight inches or so higher and over each discharge is another bushing to take care of any overfeeding of the distributer. Each bushing feeds its own launder which leads to a trunk launder from which the individual launders for each table branch.

The revolving paddles stir the pulp into a homogeneous mixture so that the pulp issuing from each discharge opening is of the same consistency. The openings are cut at the same hight, and as they are all of the same size practically an equal quantity of pulp issues from each orifice. The size of these openings is chosen so that the level of the pulp remains a few inches above the tops of the openings so that discharge takes place through the full section. Of course this distributer is not so accurate in its work as the one used at the Ohio Copper Company's mill, but it does well enough work for all practical purposes and is much cheaper to make. Moreover, if the feed has to be cut off from any table, the plugging of the corresponding orifice does not unbalance the feed of the other tables, for the amount going to each is increased proportionately.

The Yeatman Classifier

The classifier shown in the accompanying sketches was devised by Pope Yeatman several years ago for use in the Missouri lead district, and is mentioned in Richards' "Ore Dressing." It is used at the Steptoe concentrator at Ely, Nev., where, in order to increase the capacity, some minor changes have been made, such as providing two rods for moving the plug of the slot admitting the classifying current, and modifications in the manner of withdrawing the concentrates. As the drawings in Richards' book are lacking in details, it has been thought of interest to publish the accompanying drawings, which show the Yeatman classifier in its latest form.



THE YEATMAN CLASSIFIER.

DETAILS OF THE YEATMAN CLASSIFIER IN NEVADA CONSOLIDATED MILL

The main feature of the classifier is that the classifying water is admitted in a sheet through a slot rectangular in cross-section, of variable width, and extending clear across the bottom of the classifier. This results in an even upward current throughout the whole cross section and allows the pulp, as it settles, to spread out in a broad band, giving better opportunity than in the ordinary cone classifier for the undersize particles to be washed free from those of the right size and density to fall through the classifying current. The classifier is allowed to build up its own bottom; all joints are plain and square, so that there is no trouble in keeping

the box water-tight. This classifier is comparatively cheap to make. A piece of hardwood is used for the plug regulating the width of the opening for the entrance of the classifying water.

At the Steptoe mill one of these classifiers is provided with a glass side, so that the manner in which the pulp slides down the built-up bottom of settled ore particles to the classifying opening is well shown, and also the region of turmoil and agitation, just above the slot where the particles are being classified in the upward current of water coming from the waterbox below.

The advantage of this form of slot classifier is that it does its work with a minimum of attention. The fault of most classifiers is that they require attendance

BILL OF MATERIAL FOR YEATMANN CLASSIFIER

Number Required	Mark	Article	
5	A	3 x 12 in. x 11 ft.	Bottom.
4	B	2 x 14 in. x 11 ft.	Sides
2	C	2 x 14 in. x 7 ft.	Ends.
1	D	1½ x 12 in. x 17 ft.	Baffles.
4	E	2 x 10 in. x 18 ft.	Box
2	F	2 x 4 in. x 18 ft.	Nailing strip
1	G	1½ x 8 in. x 16 ft.	.....
1	H	3 x 5 in. x 14 ft.	Bevel gate
1	I	1 x 6 in. x 11 ft.	Cleats
8	J	¾ x 32 in. rods	Bevel gate
16	K	½ x 39 in. rods	Box
5	L	½ x 29 in. rods	Ends
16	M	½ x 14 in. rods	Bottom
3	N	⅝ x 68 in. rods	End
1	O	⅝ x 63 in. rods	Bottom
1	P	⅝ x 54 in. rods	Bottom
1	Q	⅝ x 46 in. rods	Bottom
1	R	⅝ x 37 in. rods	Bottom
1	S	⅝ x 29 in. rods	Bottom
3	T	⅝ x 24 in. rods	End
8	U	Lock nuts	Bevel gate rod
8	V	Guides	Bevel gate rod
1	W	6 in. pipe flange	.....
4	X	2 in. pipe flange	.....
7	Y	1 in. pipe flange	.....
16	Z	⅜ in. lag screw	.....
90	....	½ in. hex. nuts	.....
74	....	½ in. M. I. washers	.....
16	....	½ in. cut washers	.....
24	....	⅜ in. hex. nuts	.....
22	....	⅜ in. M. I. washers	.....
32	....	¾ in. cut washers	.....
8	....	¾ x 5 in. bolts	.....
16	....	⅜ x 3½ in. bolts	.....
28	....	7/16 x 3 in. bolts	.....

All rods marked J. to be threaded 6 in. on one end and 8 in. on other end.
All other rods to be threaded 2 in. on each end.

in order that they may do good work and the cause of the poor classification at most mills is the little attention given to the classifiers. The attention of the few men that are required in a large mill is pretty well taken up by the other machinery, and ordinarily it is desirable to have a classifier that will do fairly accurate work with little watching rather than an exceedingly accurate machine that must almost constantly be readjusted. Lately the Nevada Consolidated company has been experimenting with the Janney classifier. This device, when given close attention by a man who understands its operation, works admirably and does better work than the Yeatman classifier, but unless closely watched it gets out of adjustment more quickly and then does poor work.

Water in the Air Line

One of the difficulties attending the use of compressed air arises from an accumulation of water in the pipe line. From time to time devices have been suggested to draw this water, some homemade and others of the workshop variety, but perhaps one of the most simple and ingenious forms has recently been

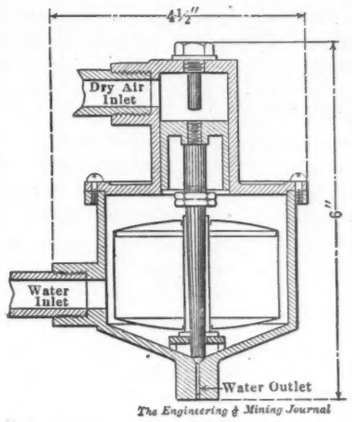


FIG. 1. EJECTOR VALVE FOR AIR LINE

developed in England. It possesses numerous advantages, among which may be mentioned automatic action, small size and light weight, which facilitates installation.

In Fig. 1 is shown the internal construction of this water ejector. It consists of a gun-metal cylinder with three apertures, two being threaded for pipe, the third being a small hole at the bot-

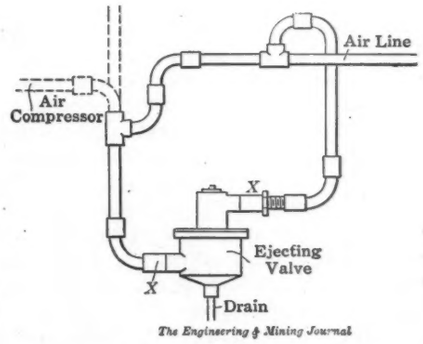


FIG. 2. PIPING FOR EJECTING VALVE

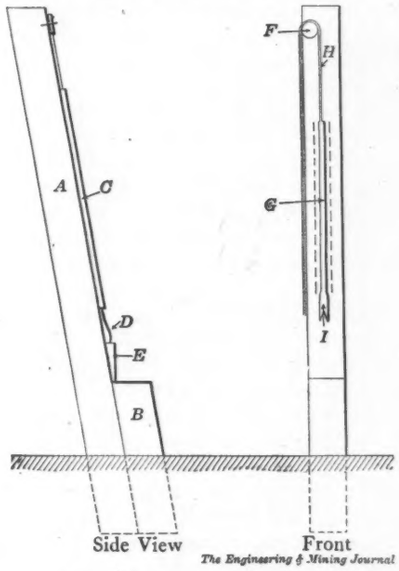
tom, normally closed by a small cone-shaped valve. This valve forms part of a gun-metal spindle carrying a copper float and provided with a plunger, upon the top of which pressure is exerted by the air in the pipe line. This is balanced by an upward pressure on the under surface of the plunger from the air from the water inlet. Under normal conditions, the pressures on the piston and float are balanced. If, however, water enters the chamber from the water inlet, the float is lifted, its length of travel being limited by a stop, and the water outlet is uncovered. The pipe-line pressure from the water inlet thereupon blows the water out of the chamber, the valve remaining open until ejection is complete. When air blows out of the water inlet, the greater pressure on the top surface of the piston forces the valve down into its seat, and the emission of air is stopped. It is, therefore, impossible for air to escape after the accumulated water has been discharged.

In Fig. 2 the method of connecting the valve to the pipe line is shown diagrammatically. Where grit or other foreign substances are likely to get into the pipe line a strainer valve *X* is inserted at each of the points indicated.

A Device for Making Wedges

BY E. JACOBS*

At the Standard mine, in the Slocan district of British Columbia, the device shown in the accompanying sketch is used for holding a piece of wood while



BLOCK FOR CHOPPING WEDGES

being shaped with a broadaxe for a wedge, such as is used in timbering a mine. The device permits the workman to use both hands, so that he can shape the wedge more quickly than if he had to hold the wood with one hand and the axe in the other.

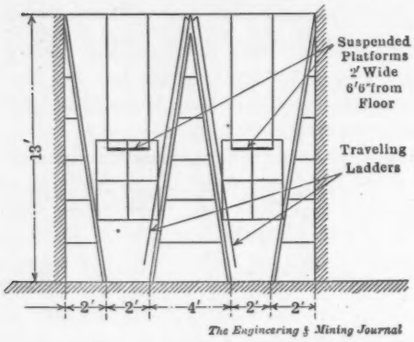
In the sketch *A* and *B* are two large timbers. To *A*, two 2x4-in. pieces *C* are nailed to act as guides to the rail *G*. A pulley *F* is fastened at the top of the post *A*, over which runs a rope *H*, tied in a hole in the upper end of the 6-ft. piece of 12-lb. rail *G*. For about six inches at the lower end the ball and web of the rail are cut off and the base split for a fork as shown at *I*. The position of the block of wood is shown at *E*; the fork of the rail, at *D*, holding the block in position.

*P. O. Box 645, Victoria, B. C.

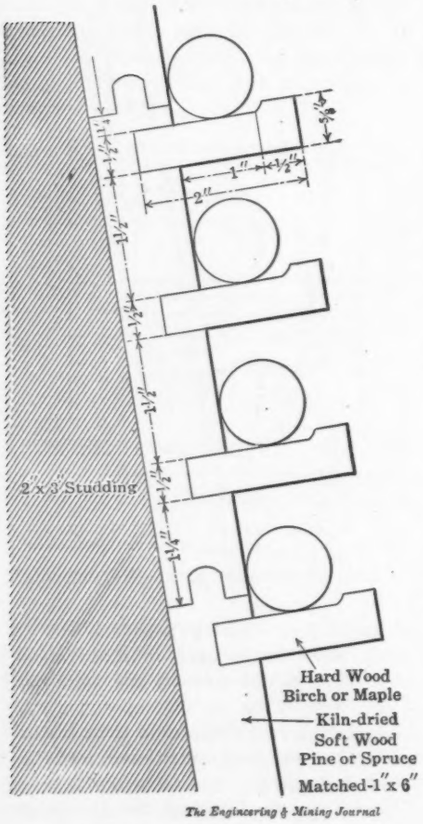
Rack for Drill Cores

By Fremont N. Turgeon*

The storage of large amounts of diamond-drill cores so as to offer a visible and easily accessible record is a problem which seems to have been solved satisfactorily by the device illustrated in the accompanying sketches. Fig. 1 shows a section across the racks, which are made in the form of A-shaped frames, out of



Section across Racks



Rack for Drill Cores

2x3-in. or 2x4-in. studding. These frames are 13 ft. high, with a passageway between them, 2 ft. wide, and are inclined at an angle of about 80 deg. from the horizontal. To economize space, half-length frames are placed at the ends of the rows. All frames are properly braced.

The framework is sheathed with dry, matched and planed soft wood, 1x6 in., which is grooved longitudinally with ½-in. square grooves, spaced as shown in Fig. 2. Into these grooves are driven hard-wood strips, made thick enough to fit tightly and of the shape and dimensions shown. To facilitate reaching the cores near the top, a platform, 2 ft. wide, is suspended between each two racks about halfway from the top; a light traveling ladder is also placed in each passageway and on one of the frames. To make the pasageways accessible to each other, openings are left at one end, high enough to permit the passage of a man, but the rack continues to the wall above the opening.

Apple green has been found to be a satisfactory color to paint the racks, as a background for the cores, and the latter are placed in the strips continuously and running in opposite directions in adjacent grooves. This rack has proved satisfactory in actual service, and is of such a nature that it could be constructed in a small shop and when set up provides large storage capacity in proportion to the floor space occupied.

*Mining engineer, Box 2005, Winnipeg, Manitoba.

Deep Sinking with Gasolene Hoists

At the Boston & Ely property at Kimberlev, Nev., prospecting has been done by sinking shafts far beyond what is generally thought to be the range of gasolene hoists. Of course, it probably would have been more economical to use larger hoists driven by electricity, but the work shows what can be accomplished with gasolene engines by those who understand them.

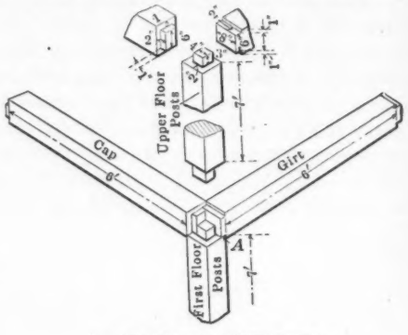
By means of a 15-h.p. Fairbanks-Morse gasolene hoist having a rope speed of 200 ft. per min., the shaft, which was timbered with 4x4-in. sets, was sunk to a depth of 840 ft., using a bucket and crosshead that gave, with the weight of the rope, a dead load of one ton. This 840 ft. was the limit of the rope and so, when a new rope was ordered, a 40-h.p. gasolene hoist of the same make was installed, but with the old hoist a speed of 50 ft. per month was attained in sinking.

With the 40-h.p. hoist the shaft was sunk to a depth of 1126 ft., it having been enlarged from one and a half to two compartments below the 1100-ft. level. In sinking to that depth a bucket and crosshead were used, but cleaning out broken rock became too slow; it took 4½ min. to hoist and return a bucket when the shaft was that deep. A cage and car were therefore substituted, and an air-driven hoist installed on the 1100-ft. level. Then by means of a bucket, which dumped into a bin on that level the shaft was sunk below that point without trouble, as sinking could go on independently of the surface hoist, at least up to the capacity of the bin. From the bin the rock was loaded into a car and hoisted to surface on the cage. This made a gross load of 3500 lb. on the hoisting rope, which was a ⅝-in. Hercules steel rope, weighing 62½ lb. per foot.

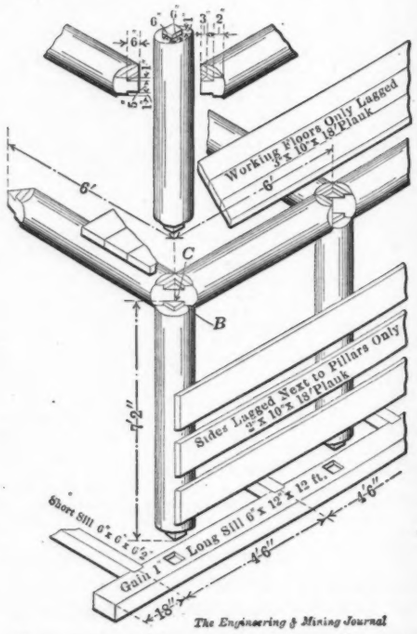
Framing of Round Timbers

By Percy E. Barbour*

The two accompanying sketches illustrate the application of square-timber framing methods to round timbers. In Fig. 1 is shown in detail a square-set framed joint, assembled. It is quite plain



Joint for Square Timber Set


Working Floors Only Lagged 2" x 10" x 18' Plank
6'
C
B
Sides Lagged Next to Pillars Only 2" x 10" x 18' Plank
5'2"
Short Sill 6" x 6" x 6'5"
Long Sill 6" x 12" x 12 ft.
4'6"
Gain 1"
18"
The Engineering & Mining Journal

Details of Square Set with Round Timbers

that there is no new principle involved in this method. However, when it is wished to produce a similar joint with the use of round timbers, the problem becomes a little more complicated. Fig. 2 shows all the details necessary to prepare round timbers for this sort of joint. It will be noticed that, whereas with the square timbers there is but one bearing surface at the end of a given piece, as at *A* in Fig. 1, in the case of the round timber framing there are two bearing surfaces, as at *B* and *C* in Fig. 2.

*Manager, Uwarra Mine Company, Candor, N. C.

Meeting of American Institute

San Francisco Correspondence

San Francisco meeting of the American Institute of Mining Engineers convened Oct. 10; many interesting and valuable papers were presented. Dredging operations of Natomas Consolidated in the American River field were visited.

The formal sessions of the San Francisco meeting of the American Institute of Mining Engineers were convoked on the afternoon of Oct. 10, with a brief address of welcome by W. C. Ralston. The morning hour was occupied with the registration of members and their guests, and such rearrangement of the program as was necessary, which varied but little from the printed form. Mr. Ralston referred to the meeting of the Institute in San Francisco in 1899, to the disaster which the city had suffered since then, to the advancement and growth of the mining industry of the State and to the future advancement that must follow the completion of the Panama canal which is to be celebrated by the exposition of 1915; and extended to the members the same hearty welcome of which they had evidence on the occasion of the meeting 12 years ago.

President Kirchhoff Absent

Vice-president Robert W. Hunt presided, owing to the absence of President Kirchhoff, and thanked the San Francisco members for the welcome and the courteous entertainment offered. Mr. Hunt recalled the incident of the receiving of the news of the disaster that came to San Francisco in 1906 by the Institute at the close of the visit to Cologne and congratulated the city upon the wonderful recovery within so brief a time. Upon motion of H. Foster Bain, Doctor Struthers, secretary, was requested to address a letter of sympathy to President Kirchhoff respecting the illness of his mother, the cause of his absence from the meeting.

"Electrolytic Refining at the U. S. Mint, San Francisco," was presented in a carefully prepared paper by E. B. Durham, who, in a short talk, briefly outlined the contents of the printed paper and set forth clearly the process and the advancement practised at the mint in the development of gold and silver bullion into coin. Mr. Durham said that some of the experiments at the mint were necessarily omitted from this account of electrolytic refining for the reason that they are still in progress.

R. W. Raymond recalled that the progress of mint refining had been thoroughly compiled in the records of the secretary of the Institute during the several years that he had held that position. He good naturedly refrained from any responsibility for the illustrations in Mr. Durham's paper, but said that it would add another valuable chapter to the Institute's encyclopedia of the progress of refining.

Bernard McDonald read a paper on the "Parral Agitation of Slime Pulp," showing the importance of the process in the cyanidation of ores. This, he said, was a new method which permits the use of tanks of any diameter and any hight. It derived its name from the mining district in which it was first successfully employed. The paper was a careful and thorough exposition of the process. B. W. Vallat delivered an illustrated address on practical mine operation in a paper on "Geology and Operation of the Newport Mine" that attracted the closest interest of the members and elicited numerous inquiries respecting various details exposed by the slides.

A highly important paper on "Progress in Electro-amalgamation," illustrated by slides, was presented by S. B. Christy. It is too important a paper to be briefly summarized, but must be read in the original in order to obtain a comprehensive idea of this magnificent example of deductive and constructive scientific investigation. The members of the Institute who were fortunate enough to hear Professor Christy and witness the illustrations will be able to more thoroughly enjoy the reading of the paper in the pamphlet form.

Wednesday's Session

Gardner Williams presided at the morning session of Oct. 11. Each paper presented was a distinctive feature of the proceedings. M. L. Requa, in a paper on "California Oil," presented a discussion upon the petroleum industry of the State that indicated profound and conscientious study of a subject that has been so variously and so badly written in the light of commercialism by thoughtless observers that it has not been often wisely comprehended. Reviewing the increase in production and the advancement of the physical operation, Mr. Requa pointed out the enormous increase in accumulated stocks and the waste the industry had suffered. He showed that the effect of putting the Standard out of business as a trust had not been favorable to the stability of the industry. This expression led Doctor Raymond to some remarks deprecating paternalism in industrial affairs and upholding individualism. The remarks of Doctor Raymond suggested to Gardner Williams that the Panama canal is one instance of a good job done by the Government. Mr. Requa's paper should be eagerly read by those who may not fully agree with all his expressions, for they will find upon careful analysis that it presents with greater precision and with more evidence of careful study the situation in California than any other exposition of the subject that has been given publicity.

Charles G. Yale's faculty for making an interesting story of figures was demonstrated by his reading of a paper on "Gold Production of California." He reviewed the statistical data that have become a part of the history of the State, and initially the most important chapter in that history. Mr. Yale has been handling the gold of California, in figures, for so many years that his compilations of the output form the only complete record from the earliest commercial production to the present year. There are nine other, but incomplete, records and Mr. Yale's is the only one that covers every year from 1848 to 1910 inclusive. So as a historian of gold production he always finds an audience. It is interesting here to note that the pinnacle of the California output was reached in 1852 with a production of $81,294,700.

In the absence of Charles Janin his paper on "Present-Day Problems in Dredging" was presented by Frank Dennis. The paper was particularly interesting from the fact that a visit to one of the dredging fields is a part of the program of entertainment of the visitors, and from the further fact that the problems are being so promptly and successfully solved by the practical application of engineering methods which have grown out of the necessity for their employment. Mr. Janin's paper will be the more appreciated by members who see the actual demonstration in the practical working of dredges placed in commission within the last few months.

"Mineral Resources of China," by Thomas T. Read, illustrated with slides, was one of the most entertaining features of the meeting. Mr. Read cited the probable great future importance of China as a producer of mineral wealth as a sufficient reason for adding to the volume of literature upon the subject.

Thursday's Session

Doctor Raymond presided at the session of Thursday morning, Oct. 12, and entered with much spirit into the discussion of the papers, particularly that of H. Foster Bain on "The Coal Resources of Alaska." Doctor Raymond contended for individualism in Alaska as in all

States and Territories of the Union. He said that it is an easy matter for a commonwealth to turn its affairs over and pay tribute to the National Government for the privilege of mining and developing its mineral resources; but that when the evil day comes upon them it is not easy to secure a cure through the whole people of the nation. He said that he would not advise a client to invest money in Alaskan coal under the present law even if the Government guaranteed it. This paper was also discussed by J. W. Malcom and A. W. Parker.

George T. Young presented a review of his printed paper on "Slime Filtration," elucidating with much clarity the experiments described, and the deductions made in the concluding page. This paper was followed very closely by the members present, and those who did not hear Mr. Young's presentation lost some interesting detail of value.

Reija Kanda, representative of the Japanese committees on the reception and entertainment of the Institute in Japan, addressed the members, extending an advance welcome and assuring them it would be his pleasure and duty to escort them and introduce them to his people. He informed them that they would find very different conditions both in industrial affairs and in the social customs and modes of the Japanese in Japan and the Japanese in America; that few of the Japanese in their own country adopt American methods and habits.

"The Fritz and Coxe Laboratories" was the subject of a printed paper by J. Daniels, which contains photographs and drawings illustrating various structural features of the buildings and apparatus, together with concise text. Other papers were presented for future publication.

At the conclusion of this formal session, Doctor Raymond announced it as the closing of the formal work of the meeting, unless there should be further demand, in which event the members would be notified.

The Excursions

On the afternoon of Wednesday, the members and their guests visited Leland Stanford, Jr., University, at Palo Alta.

On Thursday afternoon, the members and a number of their guests visited the University of California, at Berkeley, and were conducted by Professor Christy through the Mining building and other interesting departments; thence to the Greek theater, where they were addressed by Doctor Raymond and by Doctor Smith, of the U. S. Geological Survey. In announcing the absence of Doctor G. T. Becker and the fact that his "Biographical Notes on S. F. Emmons" would appear in the September bulletin of the Institute, Professor Christy paid pleasant tribute to Doctor Emmons and his biographer and introduced Doctor Raymond, who reviewed the history of the Institute, its birth and its progress on the broad lines of admission to membership of the practical miner and mine operator and the student, in company with the professional engineer. He alluded to the decade following the organization of the Institute as being one of the most important in the world's history of human progress. He paid high tribute to the engineers and the practical miners of the West and declared them the builders of the foundation upon which this great West stands firm and secure.

Dr. George Otis Smith, who left Washington with the purpose of being present at the opening of the formal sessions of the meeting, was detained at Chicago by business of the Geological Survey which could not be neglected. He expressed his pleasure at being enabled to attend this closing of the sessions. He spoke briefly—too briefly in fact, for the pleasure of his hearers would have been enhanced by more extended expression, particularly respecting his affectionate remembrance of Doctor Emmons, whose valuable assistance to the younger geologists in practical field and office work he had known by association. Doctor Smith regretted the absence of Doctor Becker, and while he sought not to speak for the biographer of Doctor Emmons, he was pleased to be in position to accord both the honor they deserve as engineers and the tutors of engineers and men beloved of their fellows.

Papers Not Read to Be Published

The following list of papers prepared for but not read at the sessions of this meeting, will be published later, and copies were obtained by members who desired them:

"Notes on Liberty Bell Mine," by C. A. Chase.

"Electrolytic Oxygen in Cyanide Solution," by T. H. Aldrich, Jr.

"A Modification of the 'Gay Lussac' Method for Silver Bullion Containing Tin," by E. J. Hall.

"Rapid Estimation of Available Calcium in Lime Used in the Cyanide Process," by L. W. Bahney.

"Cyanide Plant at the Treadwell Mines, Alaska," by W. P. Lass.

"Fuel Problems of the Pacific," by Oscar H. Reinholt.

"Government Coal Mines in the Philippines," by Oscar H. Reinholt.

"The Black Mountain Coal District, Kentucky," by J. B. Dilworth. (Discussion by J. Langdon.)

"Notes on the Geological Structure of Tonopah, Nev.," by Augustus Locke.

"Phosphorus in Coking Coal," by Charles Catlett.

"National Valuation and Quality Efficiency of Furnace Stock," by J. J. Porter.

"Historical Sketch of the Mining Industry in Japan," by K. Nisho.

"Some Features of Replacement Orebodies and the Criteria by Means of Which They May Be Discovered," by J. D. Irving.

"The Laramie Tunnel," by D. W. Brunton.

"Classification of Ore Deposits for Miners," by Augustus Locke.

"The Laws of Igneous Emanation Pressure," by Blamey Stevens.

"Physical Data of Igneous Emanation," by Blamey Stevens.

"Geology of Some Mines in South of Colombia, S. A.," by F. P. Gamba.

"Vadose Ore Deposition in Arid Regions," by C. R. Keyes.

"Electrical Practice in Mines," by Burton McCollum.

The Institute concluded a highly successful meeting on Oct. 17, when part of the members started East and part sailed for Japan on the S.S. "Manchuria." The party from New York to San Francisco comprised 67 persons, while the registry at San Francisco was over 200. The party for Japan numbered 81, of whom 26 were of the party coming from New York. The Japanese members of the Institute sent Reiji Kanda from Tokyo to escort the party to Japan, an attention warmly appreciated.

The entertainment extended to the Institute both at Los Angeles and at San Francisco was lavish. Under the leadership of Dr. Theodore B. Comstock, at Los Angeles, and of William C. Ralston and Edward H. Benjamin at San Francisco, the local committee spared nothing to give the visitors a good time. Visits to the gold dredges at Natoma where the Natomas Consolidated entertained the party and to Bohemia by courtesy of the Bohemian club were red-letter occasions. In managing these excursions Mr. Benjamin won unmeasured praise and the congratulations of all in the party.

Minnesota Steel Company

Duluth Correspondence

The new steel plant at West Duluth, Minn., is being rapidly pushed to completion, 800 men being employed on the works at present; about 150 of these are structural-steel workers in the employ of the American Bridge Company. Work has just been commenced on the 13 large concrete-and-steel coke ovens.

The steel walls and roof of the merchant mill are erected. This building will be 1040 ft. long. The foundations for the blooming mill are in and the furnace plant proper is well under way, steel being in place. The stacks of the openhearth furnaces, seven in number, are about half completed. Of the buildings, fifty in all, the shops and warehouse have been completed. One interesting fact about this new plant is that in addition to the blast furnaces there will be an electric furnace for the production of pig iron from the ore.

Alaska-Treadwell Report

The report of Robert A. Kinzie, general superintendent of the Alaska Treadwell Gold Mining Company, for the year ended May 15, 1911, shows that 770,084 tons of ore were sent to the mill, having an average assay value of $3.07. No work was done in the openpit. Ground in the north orebody from the 750-ft. level to the surface has caved, and for the purpose of extracting the ore from the caved material, what are known as bulldozing chambers were cut. About 98 ft. of additional raises were put up and 60 ft. of intermediates driven. This work has been completed on the foot-wall side and is now in use. Similar bulldozing chambers will be built on the hanging-wall side to draw the ore from that portion of the caved stope.

Development work to the extent of 9150 ft. was done during the year. The total ore reserves are estimated at 6,637,370 tons, divided as follows: 5,408,960 tons ore in place, and 1,228,410 tons broken ore in stopes. The total number of feet drilled in the mine during the year was 920,545, and the total number of tons broken was 1,021,765, making an average of one ton broken for every 0.90 ft. drilled.

Mill Record

The record of the 240-stamp mill shows: Ore crushed, 395,332 tons; crushed per stamp in 24 hours, 4.71 tons; sulphurets saved, 7339 tons; per cent. sulphurets saved per ton of ore crushed, 1.86. The following is the record of the 300-stamp mill: Ore crushed, 374,752 tons; crushed per stamp in 24 hours, 5.50 tons; sulphurets saved, 6607 tons; sulphurets saved per ton of ore crushed, 1.76 per cent.

The amount of ore crushed in both mills was 770,084 tons, an increase over the tonnage of 1910 of 25,858 tons. The cost of mining the above ore was $1.1138 per ton; the cost of milling, $0.2042; sulphuret and general expenses, $0.2107; total operating costs, $1.5287 per ton. The average assay value of the ore was $3.07, which yielded in free gold, including base bars, $1.4049 per ton, and the sulphurets yielded $0.9485 per ton of ore milled, making the average returns for the year $2.3534 per ton of ore milled.

Hydroelectric Plant Completed

The Westinghouse-Parsons steam-turbine plant mentioned in last year's report has been completed and is now in use. The hydroelectric power plant situated at the mouth of Sheep creek has been completed and is now in use. The water for use in this plant is diverted from the channel of Sheep creek at a point about one mile from the power house, and at an elevation of 612 ft. above it. The power house contains two 1900-h.p. maximum capacity single overhung Pelton waterwheel units, direct connected to two 1000-kw., three-phase, 60-cycle, 2300-volt General Electric generators. The voltage is stepped up to 22,000 volts and transmitted a distance of nine miles to Treadwell, where it is stepped down to 2300 volts and distributed at this pressure. A water-power site on Nugget creek, situated about 14 miles from Treadwell has been purchased, and a hydroelectric power plant will be constructed for the purpose of supplying additional power for the Douglas Island mines.

For the purpose of hoisting and distributing all the ore from the mines of the Alaska-Treadwell Gold Mining Company, the Alaska Mexican Gold Mining Company, and the 700-foot Claim mine of the Alaska United Gold Mining Company, it has been decided to construct a central hoisting and crushing plant. The main shaft of the 700-foot Claim mine will be enlarged and the plant so constructed as to utilize this shaft for hoisting ores from the above mines.

A steel headframe and crusher house will be constructed. The crushing plant will be placed on concrete foundations and will be entirely independent of the headframe. From the storage bins the ore will be distributed to the different mills in cars drawn by electric locomotives. With the exception of the main hoisting engine, electric power will be used exclusively. The hoisting engine for delivering the ore from the mine to the crushers is of the direct-acting type and will be capable of delivering 5000 tons of ore from a depth of 3500 ft. in 20 hours. The steam for the hoisting engine will be furnished from the boiler plant of the 700-foot Claim mine which is being enlarged for the purpose.

Concentrates Cyanided

For the last three years experiments have been conducted for the purpose of developing a suitable method for treating the concentrates economically by the cyanide process. As a result of these experiments a 100-ton plant has been constructed. Actual operations have demonstrated that the results obtained in the experimental plant can be duplicated and the concentrates treated on Douglas island much cheaper than when shipped to the Tacoma smeltery as was formerly done.

A new bath house and swimming tank was built as an addition to the club house. The club as an institution is popular with the employees and is an important adjunct to the plant. The aim of the company is to make it as attractive as possible.

A salt-water tank with a capacity of 10,000 barrels was installed at a point immediately east of the 240-stamp mill, and at an elevation of about 80 ft. above it. This equipment is to be used for supplying salt water to the stamp mills during the shortage of water in the winter, and also as an additional fire protection.

There were 19 accidents during the year, 11 of which were fatal, two serious and six slight. There were 1935 employees exposed to risk, giving a fatal-accident rate of 5.69 per thousand. The average number of men employed per day was 740, and $3.39 was the average wages paid each man.

Sulphide Orebodies in Oxidized Zones

By Charles R. Keyes.*

Of all the anomalies which mining in desert lands discloses, the occurrence of sulphide orebodies high above the bottom of the deep oxidized zone seems one of the most puzzling. Such sulphidic masses are commonly regarded as merely the unoxidized portions of primary sulphide bodies. Until recently the phenomenon has not received critical attention, and the widely accepted assumptions, in many cases at least, are now known to be quite erroneous.

That such sulphide orebodies are not remnantal masses of primary deposits is demonstrated by many facts. That it is possible for sulphidic orebodies to be formed directly from the same materials, at the same time, and in the same vadose zone as the oxidic ores, does not seem to have suggested itself. That metallic sulphidation actually takes place within the limits of the vadose zone is shown by a number of concrete examples. That it is also true in many other instances is quite possible.

The occurrence of sulphide orebodies high above the ground-water level in the midst of the oxidized ores has been explained on the hypothesis that in arid regions, where the most notable illustrations are known, the permanent water level changes from time to time. For instance, in the Robinson mining district, near Ely, Nevada, such occurrences are ascribed to a higher ground-water level at a time when the climate was supposed to be more moist than it is at present. Particular stress is also laid upon wet climatic conditions during former geologic periods, such as the glacial epoch.

Conclusive Data Lacking

Plausible as these explanations are, they do not appear to be satisfactorily supported by unquestionable data. Changes due to climate are apt to be excessively slow. Until it is shown that these various occurrences of sulphide ores within the oxidized zone are not the direct result of local impounding of waters due to favorable geologic structures, it may be seriously questioned

*Consulting engineer, Des Moines, Ia.

whether the changes in ground-water level have been so rapid or so marked as has been sometimes inferred. In a number of cases in which it was at first thought that there had occurred decided oscillations of the ground-water level, it was found upon further investigation that the sulphide bodies were disposed in basins in which, owing to peculiarities of structure, impounding conditions of the ground waters prevailed, producing all the necessary factors characterizing the profound zone.

That it is possible for ground-water level to change slowly cannot be disputed; that the rate of such change is sufficiently rapid to be recorded in the oxidation of orebodies may be seriously questioned. It is safe to deny the assumption that its oscillations are directly referable to great climatic swings between excessive precipitations and excessive droughts. The seasonal variations in the volumes of water encountered in mines, as is notably the case in the Joplin zinc district, have little critical bearing upon this point, since extensive pumping of water from the mines produces artificial conditions. In moist climates, the rainfall is so copious that the zone of permanent water saturation is always quite near the surface, and any oscillation of the ground-water level would be hardly noticeable even under the most favorable circumstances. In arid lands where the vadose zone presents great depth, the opportunity for recording oscillations of the permanent water table is unexcelled; yet direct and unquestionable evidence to support the suggestion seems to be entirely lacking. When the subject shall have been especially investigated, tangible proofs of appreciable oscillations may be forthcoming.

On account of the great depths at which permanent water level usually lies in arid regions, geologic structures play a very important rôle in the segregation of orebodies. Through this tectonic control of circulatory mine waters, a local impounding, or stagnation, is produced. The resulting ore-forming conditions are thus essentially those of the profound region. Sulphides of the metals are precipitated in the same way as when meteoric waters penetrate the deep zone.

An Example in New Mexico

One of the most convincing examples of the extensive formation of sulphidic ores in the vadose zone is presented by the lead and zinc deposits of Magdalena, New Mexico, recently fully described[1]. The principal orebodies are situated in a steeply pitching trough, which is repeatedly faulted transversely to the axis. The path of the mineral-bearing waters is chiefly downward along the tilted stratification planes, until it meets a cross fault, along which the waters rise to the level of the same bed in the next fault block. The dislocations produce V-shaped basins which overflow at a hight corresponding to the throw of the fault. Below the level of this rim and within the sides of the basin formed by the fault plane and the stratum plane the rocks are as thoroughly saturated as they are below ground-water level. To all intents and purposes profound ore-forming conditions prevail. Sulphide ores exist to the hight of the lowest point in the rim of the basin. Above this level in each fault block, the ores are entirely carbonates and oxidic compounds. This is true also below the impervious layer. To all appearances the sulphide ores were deposited at the same time as were the oxidized ores, and from the same metalliferous waters. Oxidic ores occur again below the sulphide bodies on other stratigraphic horizons. In the case of the Magdalena district, there are more than a dozen distinct faults in succession displaying the same phenomena as already described. Throughout the arid regions, like examples are of frequent occurrence. As at Ely, they appear anomalous because oxidic ores are encountered in levels beneath sulphides. Elsewhere, the lower oxide zone is not always so conspicuous, and the true genetic significance is apt to be overlooked.

Sulphide Orebodies of Vadose Origin

In moist climates where the vadose zone is shallow, it is customary to ascribe the origin of the ore materials to foreign sources. Missouri lead and zinc regions are cited in illustration. Conditions there exist that are in all respects similar to those above noted. The sulphide orebodies are largely of vadose origin; their deposition is contemporaneous with that of the oxidic ores and they are chiefly confined to basins in the vadose zone, where by peculiar tectonic conditions meteoric and ground waters are locally impounded. Other typical examples which might be mentioned in this connection are the ore deposits found in the Red Beds region of the western United States, in Santa Rita and Lake Valley, New Mexico, in Santa Eulalia, Chihuahua, a part of Bisbee, Ariz., and in Potosi, Nev. The principle is broadly applicable and its clear recognition is of far-reaching importance.

[1] *Mining Magazine*, Vol. XII, 1905, p. 109.

U. S. Lime Production

The total production of lime in the United States in 1910, according to figures compiled by Ernest F. Burchard of the U. S. Geological Survey, was 3,469,416 tons, valued at $13,809,290, a slight decrease in both tonnage and value as compared with the figures for 1909.

The five leading States in the 1910 production were: Pennsylvania, 877,714 tons; Ohio, 415,285 tons; Wisconsin, 248,238 tons; Maine, 179,656 tons; Missouri, 193,964 tons. More than half of the lime manufactured in the United States is used as structural material in mortars, concrete, plasters and whitewash.

Cloth Pinions

Cloth pinions have been developed to reduce the noise and increase the life of power-transmission gearing. Iron or brass gearing has not sufficient elasticity to successfully withstand the shocks or back-lash caused by the torque variations incident to the operation of some machines. In order to overcome these drawbacks various kinds of nonmetallic substances such as rawhide and paper, have been used instead of brass and cast iron for one or more members of gear trains. As a rule, pinions made of such substances have not been entirely impervious to moisture or unaffected by exposure to heat, and in the case of rawhide were liable to injury by rats and mice when kept in stock.

The blanks from which the cloth pinions developed by the General Electric Company are cut consist of a filler of cotton or similar material confined, at a pressure of several tons to the square inch, between steel "shrouds" or side plates, the whole structure being held together by means of rivets or, in case of exceedingly small pinions, by threaded sleeves. After the teeth are cut the cloth filler is impregnated with oil. The cloth pinions are stated to be impervious to moisture, unaffected by changes in atmospheric conditions and vermin proof.

The teeth are cut to the 14½-deg. involute system according to Brown & Sharpe's standard. Diametral pitch is the standard of measurement, and companion gears should be cut to similar form. It is claimed that the teeth are stronger than those of any other type of nonmetallic pinion, and are sufficiently elastic to allow the meshing teeth to bear evenly across the full width of face, thereby enabling the combination to absorb shocks capable of fracturing cast iron or brass. The pinions are self-lubricating, operate noiselessly, and have long life. Of several thousands of pinions in operation under severe conditions for periods ranging from a few months to two years, none has shown appreciable signs of wear.

Orders for pinions should specify the number of teeth, diametral pitch, width of cloth face exclusive of shrouds, diameter of bore and dimensions of keyway. The width of the cloth face specified should be equal so as to provide against any possibility of the shrouds running or the companion gear.

Porcupine After the Fire

By H. E. West*

The district gradually recovering from this setback. Pearl Lake section the most promising. Only two mines with proved assets. Mills are being installed and the camp has indications of permanence.

*Mining engineer, care Barclay & Co., Hayle, Cornwall, England.

Leaving Haileybury on Sept. 11 at 3 p.m., I arrived at Golden City at 9.30 p.m., having changed cars from the Temiskaming & Northern Ontario Railway main line at Iroquois Falls. First impressions of Golden City were not prepossessing. It was raining and it was dark. The wooden sidewalk to the town was minus several planks, endangering one's limbs and mud was over all. However, by following the crowd I arrived at the Murphy House, practically the only hotel since the fire. The next morning I crossed by one of the numerous gasolene launches to South Porcupine, at the south end of the lake, a trip of about 15 minutes.

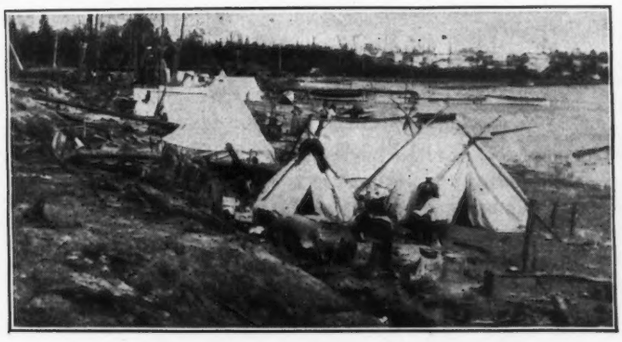
Abundance of Townsites

The Porcupine district abounds in towns. At the north end of the lake there are two, Pottsville and Golden City; at the south end, Tisdale, South Porcupine, and Lake View; about five miles westward are two more, Timmins and Matagami Heights. Unfortunately, for the most part, the townsites are in low marshy ground, a feature not conducive to clean sanitary conditions. South Porcupine is building up fast after the total destruction by the fire, two months since, and about 250 wooden structures are nearing completion, hotels, rooming-houses and banks being greatly in evidence.

The railroad runs around the east side of Porcupine lake and south of South Porcupine, thence westerly six miles to the Matagami river; about half of this latter section is completed. Construction is within two miles of the Hollinger mine, and despite difficulties, presented by muskeg and rock cuts, within a month or two should be through.

Pearl Lake District

The Pearl Lake district embraces the following mines, all of which are of considerable promise and with present favorable development: Hollinger, Timmins-McMartin, Dunlop, McIntyre, Jupiter, Plenarium and Rea. All are embraced within an area one by two miles, with the longer axis northeast. Abutting this area, which is decidedly the most proven as well as the most promising, are other properties that stand fair chances of successful development: Vipond, Success, Crown Chartered, Schumacher, Platt and Pearl Lake. It is not intimated that other properties may not be of equal promise, especially in other sections of the camp; such, however, did not come under my observation.



Porcupine City After the Fire

Remains of West Dome Plant

Dome Section

About a mile southwest of Porcupine lake is the Dome mine, together with the North Dome, Dome Extension, West Dome and Preston-East Dome. This section cannot compare in general attractiveness with the Hollinger group, four miles westward. It is conceded that all have possibilities, but outside of the demonstrated orebody on the Dome, with little or no proven assets. The West Dome has the most consistent and extensive system of veins, and development to date is encouraging.

On the North Dome the newly discovered vein being energetically opened up, presents a massive body of ore 8 ft. in width, totally unlike any showing so far seen in camp. This vein has a strike S. 70 deg. E., consisting of a hard, bluish quartz, heavily charged with coarse, cubical pyrite, and containing apparently little free gold. The ore, it is claimed, gives, by assay, high returns in gold, the latter associated doubtless with the finer-grained pyrite. The discovery took place at the acute junction with the northeast system of fracturing as evidenced in a pronounced hogback entering the property from the southwest.

Geology and Ore Occurrence

Keewatin schists dominate the entire field, varied in classification though they be. Conglomerate of Huronian age is found around the Dome section; talc-chlorite, basalt and quartz-porphyry schists are greatly in evidence.

A vitreous white quartz associated with ankerite, the calcium-magnesium-iron carbonate, is the universal matrix of the gold. The ankerite resembles siderite, being of the same rhombohedral crystal, and is, moreover, a reddish brown in color, resembling also the spathic iron. Tourmaline, hornblende and chrome-mica, an apple-green silicate, are associated minerals, and it is rather in inclusions of the green silicate than in the glassy quartz that free gold is visible. "Black quartz" is not inaptly applied to the quartz at Porcupine. The deposits are always irregular, so much so that without considerable work both strike and dip are hard of definition. Outside of the unique "dome" occurrence, which resembles somewhat the "blowout" of the West, the width varies from a few feet to perhaps 20 ft.

The Dome Property

There is but one "dome," which is on the property of that name. This is an irregular, rounded mass, rising possibly 20 ft., composed of the typical white quartz with rich stringers of native gold. In places the gold showing is spec-

tacular; on the other hand, large areas of quartz are apparently lean if not barren. The deposit is opened by a crosscut at 60 and 120 ft., I am informed, with a borehole at 500 ft. Little is known of the value of such development. Should the mass average between $6 and $8 per ton a remunerative return should be expected, as the tonnage must be large.

The Hollinger

The Hollinger is of a quite different type. At the surface are seen numerous string-quartz veins with strike anywhere from northeast to east. The main vein has been developed by two shafts about 1400 ft. apart. and there are levels at 100 and 200 ft. On the 100-ft. level, 1400 ft. of vein have been exposed, averaging 8 ft. Should the stoping width eventually average $15, there is undoubtedly a future ahead of the mine. Crosscuts on the 100-ft. level expose to the west three veins of good appearance and width; in the eastern crosscut, a fourth vein is exposed. On the 200-ft. level there are 300 ft. of ore opened up with a width and grade approximately as that above; such is my information, although I was not shown the lower level. A rich and irregular pay-streak is characteristic of the Hollinger vein. This is spectacular in places, but is apt to mislead in judging average content. The inclosing walls are of quartz-porphyry schist, contiguous to diabase schists. There seems no reason to doubt the continuation of the Hollinger veins to a moderate depth and a tonnage up to 12,000 tons per month seems not improbable eventually.

The Mill Situation

At both the Dome and Hollinger properties, mills are in course of erection, 60 heads at the Dome and 40 at the Hollinger. The mills should be running in from six to nine months. Heavy stamps, tube mills, with Merrill presses, and tanks for the treatment of the coarse sand, seem the approved reduction process.

On a basis of 10 tons per head per day through an 8-mesh, with adequate tube-milling capacity, these mills should treat 10,000 to 15,000 tons per month, in which event the costs may be expected to approach from $3.50 to $4 per ton, including all mining, milling, general charges, etc. On a basis of 25,000 tons per month, costs may perhaps be reduced to $3, but this is given more for comparison than any present expectation. Power sells at $50 per horsepower-year; timber and water are abundant, and there is a plentiful supply of skilled and unskilled labor. These should prove here, as elsewhere, essential factors in reducing costs.

Frosts are felt in mid-September, with light flurries of snow and hail in October as night sets in. In November the ground freezes and by December the snow has fallen, the waters have frozen and the Winter King reigns. The winters are cold, from zero to —45 deg. F. Porcupine is colder than Cobalt, being north of the hight-of-land on a slope falling away to James bay. In March the ice breaks up. The early summer months are rendered trying by hordes of mosquitoes by day and black flies by night; forest-fires are a menace to life and property. In the autumn the weather, save for occasional rain, is delightful, although the ground is usually damp from fallen rain.

Gold Occurrence Is Widespread

Gold has been traced through six townships, with most of the available territory staked. Finds have been made as much as 90 miles north of Porcupine. To the west the Cripple Creek section is currently well spoken of and is growing in popularity. It is too early yet to speak definitely on the whole known gold area. The properties around Porcupine proper seem shaping themselves and give promise of a fair-sized producing camp.

There has been a large amount of unwarranted boosting, especially of certain properties contiguous to the proven mines; such, to all appearance, are worthless. Consequently, by blindly following the advice of irresponsible brokers much money will be lost. Generally speaking, outside of the Dome and Hollinger, there are no proven bodies of payable ore developed. True, there are several developing encouragingly, and a number of promising prospects. More cannot be said, nor is it wise to expect too much. Should half a dozen payable mines be opened, Porcupine will have made good.

At Sudbury are copper-nickel deposits, than which there are no greater; at Cobalt, the most spectacular showing of metallic silver of which history has known. It is too much to expect a gold camp comparable to either of these. To those few familiar with the "Golden Mile" at Kalgoorlie, in the early days, or contemporaneous Cripple Creek, Porcupine does not promise to compete. There is in development, however, the most extensive goldfield the Dominion has known, which is not a compromising statement considering the history of the gold camps of the North.

Two events are retarding Porcupine. The great fire of two months since has set production back 12 months, and the Hollinger-share episode proved a severe setback to the market. From both the camp will survive.

Swastika Gold District

Consular Agent E. C. Wakefield, North Bay, Ont., reporting recently on the Swastika gold camp said that one-third of the people in the district were Americans. Swastika is on the Temiskaming & Northern Ontario Railroad, 165 miles north of North Bay, 31 miles north of the Cobalt silver area, and 65 miles southeast of the Porcupine goldfield.

The following is a list of Swastika properties on which work has been done: Dungan Gold Mining Company, Ltd.; Flynn Syndicating Company, Ltd.; Homestead Mines of Swastika, Ltd.; Hurd Gold Mining Company, Ltd.; Lucky Cross Mines of Swastika, Ltd.; Lehigh Cobalt Silver Mining Company, Ltd.; Mason Gold Mining Company, Ltd.; McKinnon Gold Mining Company, Ltd.; Otto Gold Mining Company, Ltd.; Owen Gold Mining Company, Ltd.; Peck Gold Mining Company, Ltd.; Porcupine Swastika Gold Mining Company, Ltd.; Pike Lake Gold Mining Company, Ltd.; Swastika Mines, Ltd. (the pioneer of the district); Steel Dusty Gold Mining Company, Ltd.; Swastika Gold Mining Company, Ltd.; Thompson Gold Mining Company, Ltd. The majority of these properties are being developed. Practically the entire district has been staked, covering nearly eight square miles, upon which there is a quantity of timber readily available. A siding has been built by the railway and a new station is being erected.

Coal is imported from the United States at a cost of approximately $10 per ton and will be utilized for fuel and power until water power is developed. The water power in the district is almost unlimited. Blanche river, the outlet from Lake Kenogami and its tributaries, flows through the center of the Swastika district, and Trout creek flows from Lake Comikougami at nearly the northern boundary of the new mineral zone.

Note on Cadmium Determination

The ordinary qualitative test for cadmium in the presence of copper consists in passing hydrogen sulphide through an ammoniacal solution which has been decolorized by the addition of potassium cyanide. It has been shown by L. Wohler and V. von Hirschberg that in the course of this analysis an orange-red precipitate is often formed in small quantities even when cadmium is absent. The precipitate closely resembles antimony sulphide, but it is soluble in alcohol and has the composition $C_2H_4N_2S_2$, being identical with dithio-oxamide. The formation of this precipitate is favored by a low temperature, but is hindered by using an excess of potassium cyanide above that necessary to decolorize the ammoniacal copper solution.

Mining Methods at Goldfield

By Claude T. Rice

The mineralized zone of alunitized and silicified rock is about 1000 ft. wide. Prospecting is done by crosscutting. There is little low-grade ore. Vertical shafts are used, and both skips and cages. Mining is guided by sampling and the latter is apt to be inaccurate.

To understand the general conditions prevailing underground at Goldfield, it is necessary to keep in mind the manner in which the ore was formed, for it is on account of this that the working conditions vary so much in different parts of even the same mine.

Formation of Orebodies

The first step in the formation of the ore was the profound alteration of a zone, 1000 ft. or more wide, having a general north and south direction in the producing area, through the latite, dacite and andesite country rocks. This alteration was intense and was characterized by a heavy sulphatization which altered the original feldspars to alunite, and in which the whole zone, which Ransome calls the ledge matter of the camp, assumed a rotten, almost plastic, character. Later there was a silicification of the altered rocks along lines of fracture, and it is due to this that the many silicious outcrops characterizing the mineralized area owe their origin. Still later the rocks along the mineralized zone were subjected to more intense dynamic action. Under this stress the soft alunitized mass yielded and gave way, while the silicified lenses scattered through the fractured zone forming brecciated chimneys up through a mass of much compacted material. In the larger of these lenses the channels were more open, and naturally it was up through channels of the latter sort that the ore-bearing solutions forced their way when they entered the region. As a result the ore is confined to the silicified portions of the altered zone, and in general to the larger of the silicified lenses. Consequently, as the ore owes its origin to the conditions of brecciation in irregular chimneys of silicified material, the ore occurs in rather irregular stopes and the prospecting is difficult, both of which factors increase the troubles in mining the ore. Moreover, as the ore was formed when the surface of the region was only slightly higher than it is now, the orebodies still have much of the irregularity that is characteristic of the upper portions of young orebodies.

Prospecting Is Difficult

The lenses of silicified material are from 20 to 100 ft. or more wide, and while the silicification was prior to the formation of the ore, still there is a certain relationship between the amount of silicification and the amount of ore. In general the wider orebodies are surrounded by a relatively thinner swaddling of silicious material than the smaller ones. Prospecting of a zone of altered material 1000 ft. wide in order to find irregularly distributed orebodies is no easy task and requires close study of the geology of the workings. Fortunately, most of the orebodies have a north and south course, but some of them stand at right angles to the prevailing strike. Consequently, most of the orebodies are found by crosscutting. But working in a badly altered zone is not cheap, although generally it is possible to keep the workings in the more silicious portions where the ground is stronger, since it is only in the silicified material that the ore is found.

Character of the Ore

One of the characteristics of the district is that there is little of what is really low-grade ore, for at the margin of the lenses the ore changes to waste within a few feet. As a result good assays lead to the belief that there is an orebody of importance nearby, and rarely if ever have five or six high-grade assays been obtained close together without the finding of a good orebody somewhere in the immediate vicinity. When high assays are obtained, therefore, closer prospecting is resorted to until the spilling is traced to the orebody to which it is related. In spite of this, however, it is easy to pass close to an orebody without obtaining any idea of its existence. In the Florence mine the ore has more definite boundaries than in the mines of the Goldfield Consolidated; in fact it has much the character of a lode. In the Florence the oreshoots generally have a steep pitch to the south, standing nearly vertical, and an average width of about 8 ft. But in the Consolidated mines the ore, while rarely less than 10 ft. and sometimes 50 ft. wide, unfortunately has a much flatter dip, about 30 deg. Rarely is it more than 45 deg. and sometimes it is as low as 15 deg. This flatness, of course, increases the cost of mining at the Consolidated mines.

In general the appearance of the ore gives little indication of its grade and stoping has to be guided mainly by careful sampling as work progresses, although by close study of the ore in a particular stope after considerable assaying has been done, it is possible to make a guess as to the grade of the ore, but it is not usually of sufficient accuracy to aid much in determining the border line of profit and loss. Where the tellurides and sulphides are abundant the grade of the ore can be approximated with fair accuracy, but in most of the ore the gold occurs as invisible particles so that one by ordinary inspection cannot tell such ore from barren waste unless he is intimately acquainted with the peculiarities of the ore in the particular stope from which it comes. The amount of alunite in the face gives only negative information; that is, if there is no alunite in the face, there is little chance for ore. There is visible gold in some of the ore but this is rare; practically all of the ore stolen by the high-graders in the heyday of the camp consisted of sulphides in which the bismuthinite, pyrite and telluride minerals gave an indication of the richness. In fact, it was because this ore carried a fairly constant percentage of tellurium that it was possible to identify it as stolen from the Goldfield Consolidated workings.

High Class of Labor

The union has lost its power at Goldfield, and the "highgrader" is gone, along with other of the undesirable element that flocks to a camp where labor is running things with a high hand. In the readjustment the best men have been selected from the large number that thronged the camp from all parts of the country during the boom times; as a result, there remains a picked crew of some of the finest miners in the country. It should also be added that the mines work but six days a week, which is desirable as most of the miners in the district are married. If they were the ordinary set of unmarried men that characterize Western mining camps, probably this would not be true, as they would be more tired Monday morning than they were Saturday night. The mill runs every day as it would break up the routine too much to close down on Sundays.

There is no longer a fixed scale of wages in the district. The Florence pays miners $4 per eight-hour shift, timbermen $4.50, and shovelers and carmen $4, while the Goldfield Consolidated pays miners and timbermen $4, and carmen and shovelers $3.75 per eight-hour shift. The object of the Florence is to try to secure the pick of the camp in recompense for the higher wage paid. Whether the company gains by this policy I could not determine.

Vertical Shafts Used

The mines are all worked by vertical shafts which start in the hanging wall of the altered zone and pass into the ledge matter at a short distance; for while the ore in the Consolidated mines dips flatly, no other kind of a shaft would be practical, as the orebodies are irregular and different lenses of ore come in as other lenses go out in the same horizon.

In exceptional instances these shafts have cut into orebodies, and the necessity of protecting the former with pillars has locked up some ore as in the case of the main shaft at the Florence mine. At the older shafts wooden headframes are used, but at the newer ones steel frames are being installed, as they are cheaper in the long run than wooden ones, in a place where labor is high and freight rates exorbitant.

Ore Becomes Pasty

At the time of my visit to the camp last winter skips were in use at only the Clermont and the Florence shafts, although provision was being made at the Laguna for their use as soon as actual mining begins. At the other shafts, cages and end-dumping cars having a capacity of 20 cu.ft. were used. The skips used at the Clermont hold two tons, while the station pockets have a capacity of 75 tons. At the Laguna the skips will also have a capacity of two tons, but it is probable that pockets will not be provided on account of the difficulty in getting the ore to run from them when it is wet, owing to the large amount of alunite in it, which makes a pasty, clayey mass out of the ore.

At the Clermont the bottoms of the pockets are given a slope of 50 deg., as it has been found that the wet ore packs less on that grade than any other. Moreover, on account of this stickiness the chutes in the stopes are offset frequently so that their general profile has a slope approximating 50 deg.; if vertical chutes were used and the ore dropped more than a few feet, it would pack so solidly at the bottom that it would be difficult to loosen it. In fact, in the case of some of the vertical chutes it was necessary to bore holes into the sticky mass and shoot the ore to start it. At the Laguna headframe a waste pocket as well as an ore pocket is provided.

Round ropes are used entirely in hoisting and the old steam or air hoists are rapidly being replaced with electric, geared hoists. The mines make little water, only about 75 gal. per min. from all the mines of the Consolidated company, the workings of which have a total length of approximately 34 miles. The pumping is done by means of electric-driven Aldrich triplex pumps. The mine workings are comparatively shallow, as most of the ore comes from above a depth of 400 ft. and little from below 600 ft., although the Clermont shaft is over 1000 ft. deep.

Central Timber Yard

Owing to the scattered condition of the Consolidated mines, the company has a central timber yard where ample protection against fire is provided by means of fire monitors mounted on raised stands so as to enlarge their scope of action. In fact, one of the features of the Consolidated is the ample protection provided against surface fires. This is necessary because of the small size of the water supply at Goldfield. The timbers for the mines are framed at the yard, there being only a wedge saw at the mines, and that at only a few. This timber comes mainly from the coast, and the freight rate is high. At Bingham, where the mines have to face the same conditions and the cost of labor is less, the companies have found that it pays to ship the square-set timbers in already framed. Conditions at Goldfield seem to be still more favorable to such a procedure.

Air-hammer and Piston Drills Used

The ore is comparatively soft at Goldfield, and the same holds true of the silicified ground surrounding the ore so that most of the drilling other than in the drifts, winzes and shafts, is done by means of air-hammer drills, although in the Consolidated stopes, owing to the flatness of the dip, piston drills are almost as numerous as the hammer drills. Both at the Florence and at the Goldfield Consolidated the Waugh air-hammer drill is used, although at both mines most of the other makes have been tried. In some respects the Ingersoll Imperial valveless drill is liked at the Consolidated mines fully as well as the Waugh. The Waughs have been in use at the Consolidated mines for over a year, and about 100 are in operation, while at the Florence 18 Waughs are used. The Consolidated company has found that the cost of repairs, lubricant and air for a Waugh drill is from 10 to 11c. per ton of ore broken, and that the chief wear on the Waugh drill is in the valve. At the Consolidated mines underground machine shops are rigged up so that the drills can be repaired without sending them to surface. This has been found to effect some saving. In the development work, Ingersoll-Sergeant A 50, 2¼-in. drills are used, while at the Florence 2¼-in. Sullivan machines are employed for this purpose.

It is partly the dip of the orebody but mainly the dampness of the ore itself that determines whether a piston drill or a hammer drill shall be used in the stopes at the Consolidated mines. With holes as flat as 15 deg. fair speed can be made in dry ore with an air-hammer drill, provided the drillings are cleaned out of the hole every six inches. Where the ore is at all damp the air-hammer drill is immediately at a great disadvantage, no matter what the dip of the hole, and the piston drill will bore much faster. Throughout the Consolidated mines, averaging in the flat holes along with the steeper ones, the air-hammer drills bore approximately 45 ft. per shift, although in good rock where the miner is not bothered by anything else and the ground works well, the Waugh drills often bore as much as 100 ft. per shift. The 2¼-in. piston machines average about eight holes, 4.5 ft. deep, per shift. At the Florence probably the average of the air-hammer drills is slightly higher than at the Consolidated mines, as few flat holes have to be drilled in the stopes at the former mine. An air pressure of 90 lb. per sq.in. is used.

Word drill sharpeners are used by both the Florence and the Consolidated companies. At the Consolidated mines, where the sharpening for the different mines is all done at one place, two men have no difficulty in sharpening 700 drills in an eight-hour shift with the machine, probably two-thirds of the drills being for air hammers. At both properties the Word sharpeners have given great satisfaction. In breaking the ore 40 per cent. dynamite is used.

Factors Affecting the Mining Methods

The method used in mining the ore from any particular body depends mainly upon the strength of the surrounding casing of silicious material which separates the ore from the altered ledge matter, and also upon the condition of the ledge matter surrounding the silicious lens, for the andesite in the Florence mine seems to have more of a tendency to flow than does the dacite, when openings are made in it. But whether the rock be altered andesite, dacite or latite, it has a tendency to flow slowly toward openings made in it, for the kaolin and alunite, especially when the mass is slightly damp, act as a lubricant between the pieces of less altered material scattered through the mass. This rock literally moves on itself, and in many places in the andesite of the Florence mine local slickensides have been developed in the andesite where the silicious blanket around the stopes was not strong enough to resist the movement until the stope could be filled. Moreover, when the rock becomes wet it has a tendency to swell as well as to flow.

In the larger orebodies, such as are more characteristic of the mines belonging to the Consolidated, it is generally necessary to mine with square sets, but there are exceptions depending upon the thickness of the silicious envelop surrounding the orebody. For instance, in the Mohawk workings of the Consolidated there is a large stope, which was mined out without the use of any timbers, that has stood for a long time without any sign of caving. Also, on the 200-ft. level of the Florence, near where the long

crosscut starts toward the Baby Florence workings, there is a stope 50 ft. wide and 75 ft. long, from which the ore has been mined to a hight of 100 ft. by using a shrinkage system of mining. This stope at the time of my visit, although there had been considerable abrasion of the walls in drawing the ore, had stood for several months without any bad falls of ground, but was then being filled as fast as waste could be obtained from nearby development work.

Whether the shrinkage method can be used is entirely a question of the condition of the walls and the thickness of the silicious mantle. Generally in the upper parts of the mines it is possible to determine the thickness of the silicious envelop by studying the numerous drifts and crosscuts that leasers drove in their search for high-grade ore. In fact, it was due to such a study that the superintendent at the Florence was bold enough to mine such a large orebody by the shrinkage method. Moreover, by utilizing these old workings for ingress and egress it was possible to mine the ore with perfect safety, as far as being locked in the stope by caving was concerned, and without carrying a single raise up through the filling.

But even when the silicious walls are strong enough to resist the pressure of the ledge matter behind them, they are generally so rotten that, unless the ore is so low in grade that the admixture of wall rock will not appreciably lower the grade of the ore coming from the stope, it is cheaper in the end to draw the ore from the chutes as fast as it is broken, either filling the stope as mining progresses or after all the ore is mined. The latter is the cheaper practice when feasible.

Mining Methods at the Florence

This is the method mainly used at the Florence, as the orebodies there are about 8 ft. wide and stand at a steep angle, with the walls generally well silicified, although not solid enough so that the shrinkage method can be used often. Stulls are put in partly to aid in supporting the walls and to carry a stage for the men to work on, but mainly to hold the platforms on which the ore is blasted and also the timber slides which extend from the ore chutes at an angle of about 50 deg. and on which the broken ore drops and from which it slides into the chute. These slides or wings are kept within about 15 ft. of the roof and the latter is carried up about parallel to the slope of the slide. This enables the waste filling to be run in under the slide by gravity, and keeps the ore from mixing with it.

In the weaker stopes the stulls are put in with double 2-in. headboards; as the pressure comes on, the stull is forced straight through both headboards, the first movement being generally so slow that they do not split. But toward the end the movement increases in rapidity, and by the time the walls have moved in 4 in., so that the ground is against the stull itself, the speed is so great that the stull breaks after only a short period of bending. The space left between the filling and the roof depends upon the strength of the walls. In the stronger stopes it is permitted to lag behind the mining, or is even omitted until all the ore in the stope is mined out, but in the weaker stopes it is kept up next to the wings. This waste comes from development work, and there is always an ample supply if ore is developed as fast as mined; the development work is planned to be done when the ore in that part of the mine is being mined, to avoid tramming the waste filling a long distance.

Old Stope Walls Shattered

In the Florence the leasers have gouged out the center of most of the orebodies, leaving the lower-grade ore on the walls. The pressure of the vein matter behind has caused the silicious envelop to weaken so that the walls of these old stopes are badly shattered in many instances. But by using the method of wings already described, keeping the filling close up under them, putting in an occasional stull in the old stopes and by cleaning the walls down carefully, it has been possible to mine the low-grade ore without much danger and with little increase in cost; however, part of the ore which should bear the cost of the work has already been mined.

In the Goldfield Consolidated mines the narrow stopes generally stand at such a low angle that the timbers supporting the roof are more like posts than stulls. In these flat stopes no use of the gravity plane is made. This seemed to me to be a mistake, and I could not help but think that a little copying after the latest practice at the North Star mine, at Grass Valley, Cal., would be profitable to the company. Fortunately, most of the orebodies at the Consolidated are wide, and probably the men in charge think that gravity planes would hardly pay because only a small proportion of the total ore mined comes from these narrow, flat stopes.

The timber used for stulls at the Florence mine is Oregon fir or spruce, and costs the company at the mine 25c. per running foot of stull scaling 10 in. at the small end. The average distance that the ore is trammed at the Florence mine is about 700 ft., the longest tram being 1500 ft. and the shortest 200 ft. The waste for filling a stope is generally trammed only a short distance. In some of the narrowest stopes that are not under buildings no filling is used, but where the stope is near buildings the filling is kept up close to the roof. The ore is hoisted in skips holding about 3200 lb. of ore, but a two-ton skip, having some novel points in its design, was about to be installed at the time of my visit.

Now we have come to the matter of costs. Unfortunately the article is already too long, so the statement of the mining costs in detail must be left to another article which will appear later.

Square-set Mining at Consolidated

Formerly the practice at the Goldfield Consolidated mines was to use 10x10-in. sets and to mine the orebodies with several floors open, the object being to save, through the lower cost of filling, the extra cost of the timbers required in bulkheads, doubling-up posts and the like. Several stopes were lost in this way, the ground being too heavy to leave several floors open as is the practice at the Comstock. So during the last two years the mining has been patterned more along the lines of the Copper Queen practice at Bisbee, the ore being mined in sections. These sections run from wall to wall of the orebody and are seven sets or 35 ft. long in the direction of the strike. The stopes are worked as rapidly as possible, to get the ore out before all the weight of the roof settles on the timbers. This change in practice, introduced by Joseph Donnelly, the present mine superintendent, has made it possible to work practically all the stopes with 8x8-in. timbers, 10x10-in. sets being used only on the sill floors of the stopes and in some of the heavy stopes in the shattered areas adjacent to old lease workings.

The flat dip of the orebodies has caused the use of a novel method of cutting out on a floor, while the small size of the sets has required the use of blasting timbers to keep the caps from being broken by the shots.

Framing of Timbers

The framing of the timbers follows Comstock practice as the posts butt against each other, this being proper as the weight in the Goldfield stopes is more downward than sidewise. The stope timbers are framed so that the posts stand at 5-ft. centers, both capways and girt ways. The caps and the posts are cut from 8x8-in. timber, while the girt is a 6x8-in. piece cut off to the right length, 4 ft. 7 in. long. The posts are framed so that the floors are 7 ft. apart in the clear, and the horns at each end are 5 in. square and 4 in. long, making the posts 7 ft. 8 in. over all. This gives to the caps and girts a shoulder 1½ in. wide to rest on. This is rather narrow, but as the side pressure, owing to the manner in which the ore occurs, is about equal both capways and girtways, there is little swinging of the sets, and the timbers appear to have ample hold.

On the sill floor the posts are framed 8 ft. in the clear so that it is necessary to use 10x10-in. timbers for them, and the caps are also framed from the same size, but as the sill posts have a top horn 5 in. square, the sill girts are framed from 8x10-in. timber. The sill posts are

flat bottomed and stand on 8x10-in. sill timbers with 2-in. spreaders between. These sills are put in as long as the ground will permit, and there is no brace put in between the different sill stringers. On the sill a double floor of 2-in. planks is laid criss-cross so as to make it easier to catch up the level when the stope comes up from below. Often double-length caps are put in on the sill floor so as to give greater flexibility to the track in case that, on account of irregularities met with later in the development of the orebody, it becomes necessary to swing the track. When a double-length cap is used, a round post is placed under the cap on each side of the track, but generally no brace is put in from cap to cap girtways. This should be done if the ground is at all heavy so as to preserve the continuity of the truss on the sill floor. By using double-length caps greater flexibility of track is obtained, which aids considerably in the tramming, but it is doubtful if the use of such caps is entirely commendable in case the ground is at all heavy.

Method of Stoping

In starting a stope, a raise is first put up to the level above, down which waste can be run into the stope. Then, as stoping advances, chutes and manways are carried up 25 ft. apart so that rarely does a shoveler have to throw the ore farther than 12 ft. Owing to the flat dip of the orebodies, which averages about 30 deg. throughout the mine, it is generally necessary to put in a second line of chutes to serve the upper part of the stope, for the chutes, owing to the stickiness of the ore, have to be carried up by offsets so that in profile they will have a general slope of about 50 degrees.

In this rather heavy ground, in which the roof dips at only 30 deg., when such small timbers as 8x8-in. sets are used, it has been found necessary to cut out under the hanging wall and fill the hanging-wall sets with waste before mining becomes general throughout that floor. In this manner the self-supporting arch of the roof is made to spring from within the ore itself, instead of from the boundary of the orebody, where sometimes there is a line of weakness already existing. Moreover, in this way the spread of the arch is made less, and consequently less of the weight of the roof falls upon the timbers.

Consequently, when mining begins on a floor, a crosscut is first driven to the hanging wall, and a slice two or three sets wide mined out along that wall. The hanging-wall sets of this slice are then filled with waste, 2-in. planks being nailed to the side of the hanging-wall sets facing the stope so as to confine this filling next the hanging, and yet allow the planks to be knocked off later when that becomes desirable. Then slicing across the stope from the foot to the hanging begins. When the mining has been completed on that floor, it becomes the shoveling floor, and the cutting out begins on the floor above just as it was done on the floor below. The filling of the old shoveling floor then begins, and as the filling rises next to the hanging-wall fill the plank laggings are knocked off one at a time, so as not to let the waste run away from under the hanging wall. These planks are then used for lagging on the floor above. For lagging off the waste filling from the ore in the next block to be mined, old planks that have been broken in use as flooring are used. In the stopes a double 2-in. floor is used, while on the top floor the sets in the vicinity of the blasts are covered with a floor composed of poles 6 in. in diameter and long enough to reach over three caps. These are locally called blasting timbers and in this way the caps are protected from being damaged by the flying ore.

Laying the Floor in High-grade Stopes

When working in high-grade ore, the filling is carried about 3 in. higher than the caps on the mucking floor, the last 2 in. being fine material. This covering is smoothed off, and the floor is then laid on top of the filling, but by the time that the floor above is mined out, the filling will have settled until the top of it is only 1½ or 2 in. higher than the caps. As soon as mining is finished on the floor above, the planks are swept off and taken up. The waste above the caps is then skimmed off, and this is mucked into the chutes as the fines will have enriched it enough to make it of fair grade. In this way the loss of fines is prevented in a much better and cheaper manner than when canvas is used under the planks, for the canvas soon gets full of holes.

At present only two floors are left open in the square-set stopes, the others being kept gobbed up tight. This waste filling comes entirely from development work, and there is not a single raise driven from a stope for filling, in all the Consolidated mines. Whether it is advisable to go to all this bother of cutting out along the hanging wall appears doubtful to me, as it slows up the speed of mining. In fact, I half suspect that the lessening of the weight on the timbers in the stope, which would result from the increase in speed due to the cutting out of the floors in the ordinary manner, would more than balance the gains effected by means of the unusual procedure at Goldfield.

As the ore in the Goldfield Consolidated stopes is extremely variable in grade, sampling has to follow the mining closely. Owing to the fact that the ore is spotty, in that hard and soft streaks occur scattered through the ore, it is difficult to get a fair sample even by means of cuts, and consequently the only way to insure accuracy is to take a great number of samples. Therefore at the Consolidated mines the main reliance is placed on a great number of large grap samples, and only when the grade of the ore approaches the limit of profitable mining, which at this property is somewhere in the neighborhood of $6 per ton, is recourse had to the more expensive and more tedious cut sampling. In case that the samples coming from a stope for five days in succession assay less than that amount the stope is put on development until the grade of the ore is carefully determined by cut sampling. Then the fate of the stope is decided.

Distributing Explosives

The Goldfield Consolidated has an admirable way of distributing the dynamite to the miners. The tool nipper on his morning trip through the mine finds out from the different miners how much powder each will need at blasting time, as well as how many holes the miner will have. This the nipper writes down in his notebook for each miner, together with the number of the working; later in the shift he makes up the different orders, putting in a separate box for each level the dynamite and capped fuse desired there. On a slip accompanying the box is written the amount of dynamite, each miner getting his powder at the level ordered, so that each man can see how much is in the box for him.

The amount of dynamite used by each miner, together with the number of caps, the amount of fuse and the number of the working, is reported by the nipper to the shift boss at the end of the shift, and the shift boss in turn enters it on the chart used in keeping account of the supplies and labor to be charged to each working. In this way the cost of the explosives used in each working is kept for comparison, and the knowledge that the bosses are going to know how much dynamite a miner uses, as well as how much dynamite is used per ton of ore broken in each working, and that comparisons will be made, causes the miners to be economical in their use of explosives, and little dynamite is seen lying about in the stopes.

But the main advantage of this method is that it does away with the necessity of having numerous auxiliary magazines scattered throughout the mine, and only one man handles the dynamite, where it is in quantity. This is far safer than where every Tom, Dick and Harry who knows enough to crank a machine drill and tote a T-D pipe in his mouth has access to the supply of explosives. Of course, a small quantity of dynamite is kept on the different levels for the men in case that dynamite is needed before the nipper can get powder down or in case that toward the end of the shift a miner finds that he needs more dynamite, caps and fuse than he had thought; but this quantity is insignificant compared with the amount that must be stored on

the different levels when the men are allowed to get their own dynamite out of the boxes.

Advantages of Distributing the Explosives

This system of distributing the explosives is similar to that used at the Daly West mine some time ago, except that at the latter mine the nipper brought the explosives to the miners at their working place. Where one-man drills of any type are used, this is an advantage as it allows the miner to drill up to the last minute, if necessary, to get in his round. This system is safer as the capped fuse is furnished to the miners and misfires are less apt to occur than where the miners cap their own fuse, possibly nipping the cap on with their teeth. The caps, and especially the fuse, are kept in a dry place, and at the proper temperature, so that deterioration is avoided and misfires do not occur on account of damp fuse or caps, and should not occur on account of improper capping of the fuse. This system of distributing the explosives either to the level or to the different working places is more economical and much safer than the old way which involved promiscuous handling.

The Consolidated mines are well ventilated by means of the numerous shafts put down by leasers in their search for ore, and the men are allowed to blast in the middle of the shift if they desire to. This, I believe, is bad policy, no matter how good the ventilation; for if a miner blasts in a stope during the shift, he drives all the others out of the stope for about 20 min., the smoke goes on to another working and possibly gives a headache to someone susceptible to dynamite fumes, thus lowering his efficiency. I think it wise to compel the miners to confine the blasting to the end of the shift, unless the shift boss, on making his rounds, gives the miner special permission to blast before the regular time.

Inspection of Workings to Prevent Accidents and Fires

As another step in making the miner's work safer, for the manner of distributing the powder is surely a step in that direction, the company has adopted a plan somewhat similar to that of the Calumet & Hecla company. An inspection department is maintained, the main duties of which, besides keeping the fire-fighting apparatus in proper condition, is to inspect all hoists, cages and working places to see that they are in safe condition, and to investigate all accidents. This not only aids in making mining safer, but by their trips through the mine the inspectors keep the men from getting careless, and compel them to be watchful of themselves and their neighbors; a miner who is remiss in keeping his working place safe is considered by the Consolidated company as worthy of being discharged as if he had not done a fair day's work.

As a protection against underground fires the company, following the practice of most square-set mines, employs "fire-bugs" to go through the mine after each shift, to prevent fires starting from lighted candles left in stopes. Probably in a mine where the ore is of such high grade as that in many of the stopes at Goldfield the employment of such a man is a good investment as fire insurance; as an additional precaution, much danger from this source could be removed by adopting the Copper Queen practice of using sconces to hold the auxiliary lights left at chutes and other places to aid in lighting the miners at their work. A sconce is simply a device, made of cast iron, at Bisbee, for holding the candle so that the flame cannot possibly reach a timber, and also to catch the grease and keep it from running on the timber, where it might form a trail along which the flame could travel. These sconces are cheap when made in quantity, and since their use has become general at Bisbee there has not been a single underground fire, I believe.

It is practically always the snuffs, the auxiliary lights, that start the fires in mines, for they are the only lights likely to be left burning in the mine; a candlestick is of too much value for a miner to leave. After the miners have become accustomed to the use of sconces there is no necessity for fire-bugs to go through the workings, unless men are blasting in a network of timbers in some old stope. Even if it is thought advisable to have a fire-bug, sconces ought also to be used in timbered mines, as a fire-bug is human; they have been known to fail to go to all the workings, and fires have started in such mines in places where it is doubtful if it could have been the sulphide ore that caused the "mines to set fire to themselves."

In order to remove the danger of fires starting around the cans in which the oil for the machine drills is kept, these cans are always hung from a post in an untimbered drift near the station; to prevent wasting of oil through failure to shut off the flow at the proper time, a small sheet-iron pan is hung by a long bail from the oil-can cock so that it is out of the way while oil is being drawn and yet underneath so as to catch any overflow.

The Level Interval

The level interval in the upper workings of the mines at Goldfield is 50 ft., for that was the interval generally adopted by the leasers. The companies, when they began mining, increased the interval to 100 ft. The Florence company has been satisfied with this, but the Goldfield Consolidated has deemed it wise policy to increase the interval to 150 ft. in the lower parts of its mine where it is claimed that the ore becomes more regular. This seems to me to be a mistaken policy. The only reason for a long level interval is to decrease the cost per ton for opening levels and cutting stations. In a mine where the ore is very regular, such a course is a wise one, but in a mine where the ore is high grade and the occurrence irregular, the most important thing is to find the ore rather than to mine it at the least possible expense. Intermediate levels can, of course, be used for prospecting between the main levels, but unless stopes have been opened up in the lower half of the block, the handling of the waste becomes expensive, and either the prospecting of that ground is neglected or else the intermediate has to be connected to the shaft after all. At Goldfield, where the shafts are in the vein matter, crosscutting is good prospecting wherever it may be done in the mineralized zone.

In conclusion, I wish to thank J. R. Finlay, the late general manager, and Joseph Donnelly, mine superintendent, of the Goldfield Consolidated company, and Willis Lawrence, general manager of the Florence-Goldfield company, for their kindness and the information given me for use in this article, as well as for the cost statements which will appear later.

Electrolytic Antimony

M. Ruthenburg, of London, has patented (Brit. pat. 19,772, Aug. 24, 1910) a cyclic process for the production of antimony. A solution of ferrous and antimonious chlorides, obtained by treating stibnite with ferric chloride, and containing 1 lb. of antimony per gallon, is electrolyzed between soluble iron anodes and insoluble cathodes until about one-half of the antimony is deposited. The remaining liquid is then oxidized—by a hot-air blast or otherwise—the resulting solution of ferric and antimonic chlorides being employed for the treatment of a further quantity of stibnite.

Chromax, a New Alloy

A new alloy of chromium, copper and nickel, chromax bronze, claimed to be the only copper alloy containing chromium, has recently been patented (*Iron and Coal Trades Review*, July 28, 1911). As a bearing metal it is said to be unrivaled, and it has a high fusing point of 1200 deg. F. It is stated that it will not fuse nor cut even if raised to red heat by friction, and will stand 20,000 lb. pressure per sq.in. on a 6-in. bearing surface at slow speed. The alloy has a tensile strength of 79,000 lb. per sq.in. with an elongation of 3.3 per cent., and is extremely dense. It is acid proof, noncorrosive, is not affected by sea water, and can be rolled into sheets and wire.

Scheme for Valuing Ore in a Stope

By Lee Fraser *

Plotting two new factors on a stope map, instead of the customary assay-width data, causes variations in value to become more apparent and instructive.

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The assay and sample record here described consists of the following six loose-leaf forms, several of which are illustrated in the accompanying engravings: (1) Sample record. (2) Assay record. (3) Assay and sample record. (4) Tonnage and value record for stopes. (5) Assay and sample record of developments. (6) Assay and sample record—computations.

The operation of this system is simple and proceeds as follows: Upon taking the sample, the data called for in the sample record (Fig. 4) are secured; sketches of a cross-section of the vein at the place of sampling are made, together with necessary remarks in connection with the sample.

The identification slip is then detached along the perforated line and is placed with the sample inside the sack; when the sample is wet, or is liable to rough handling before reaching the assay office, better protection is gained by folding the ticket and slipping it into a steel clip. The sample record is then filed in the office for future reference.

The assay results from these samples are then sent to the office, whereupon the sample is entered, with the sketch, value, and all other data, in the assay and sample record provided the sample was taken in a drift, winze, raise or crosscut. But if the sample was taken in a stope, the entries are made in the tonnage and value record for stopes, as will be explained.

When the distribution of the values in the ore is at all erratic it will be of great assistance in carrying on the work of development to plot the values and widths, as derived from the samples, in the assay and sample record of development.

In this manner, any slight increase in values, which may indicate the presence of a shoot near that point, will be readily noticed.

It is the function of the stope map to convey readily information as to the tonnage mined and its gross value, and also as to particular tonnages and values, thereby indicating the trend of the shoots of payable and nonpayable ore; it also conveys information as to the amount of minable ore and its gross value.

For recording the results of samples and measurements on the stope map, preliminary to making estimates, actual assay returns and corresponding widths of vein may be written in, or symbols representing certain values, or occasionally dollars-feet, inches-dollars or ounces-inches may be used. Sometimes the vein width is entered as equal to the minimum stoping width, when the actual width of vein is less than that dimension, a correction being applied to the assay values if these are being plotted; or if the dollars-feet factor is used, the width of vein is corrected. On the other hand, the sample may be taken across the face to represent the ore being sent to the mill, including waste up to the minimum breaking width, where the vein is less wide. Many other methods will suggest themselves for making these corrections.

But none of these systems, to my mind, gives prompt information as to the amount of ore mined or its value; when the assay values alone are plotted they tend to confusion, until the proper relation has been worked out between the importances of high values with narrow widths, and low values with great widths.

I wish to propose the use of a tonnage factor f, equivalent to one-quarter the width of the vein in feet, at point of sampling, divided by 10 times the number of cubic feet of ore in place per ton; also a value factor i, equivalent to f times the assay value per ton of ore at point of sampling. I then propose to form quadrilaterals on the stope map, by joining the points of sampling, and

SAMPLE AND ASSAY RECORD.

Company Page

Mine Place

No.	Date	Location	Θ	D	∠	Width-Ft. Total	Width-Ft. Ore	Width-Ft. Wst.	Ounces Silver	Ounces Gold	Dollars per Ton Silver	Dollars per Ton Gold	Dollars per Ton Total	f	i	Remarks	Sketch	Remarks	No.

The Engineering & Mining Journal

FIG. 1. FORM FOR FILING IN OFFICE

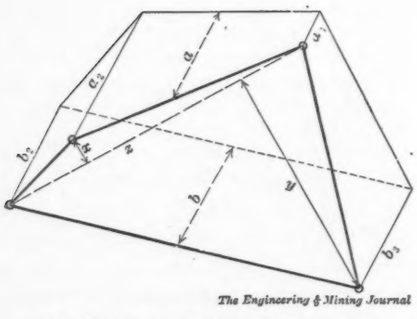


FIG. 2. GRAPHIC REPRESENTATION

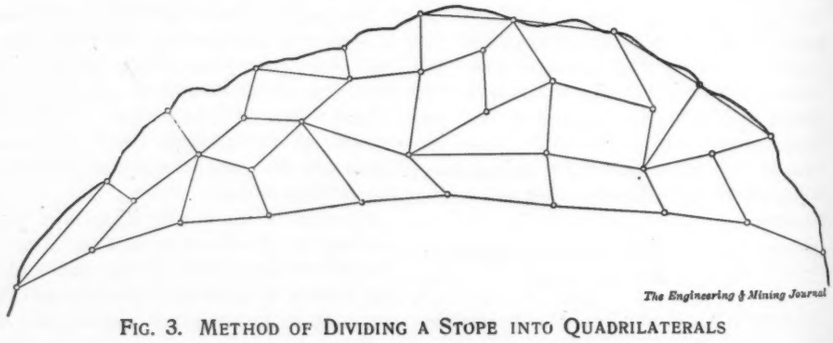


FIG. 3. METHOD OF DIVIDING A STOPE INTO QUADRILATERALS

to color each quadrilateral some tint denoting either the average value of the ore therein contained, or its gross value and amount.

Referring to Fig. 2, the circles represent the location of four samples as plotted on a stope map, and the lines a_2, b_2, a_3, b_3, the widths of the vein at these points. Then we have:

$V =$ Volume in cubic feet.

$A =$ Area in square feet $= \left(\frac{xz}{2} + \frac{yz}{2}\right)$,

$m =$ Number of cubic feet per ton of ore in place.

$f =$ Tonnage coefficient $= \frac{1}{4}$ width of vein in feet, divided by 10 m.

$i =$ Value coefficient $= f$ times assay value per ton of ore.

SAMPLE RECORD

Company

Date

No. Sampler

Location

Reference

Dip Angle

Remarks

Sketch- 1" 10'

No. Company

The Engineering & Mining Journal

$E =$ Total value.

$T =$ Total tons.

$n =$ Number of samples taken.

FIG. 4. FORM OF FIELD NOTE

$a =$ Average width.

Then,

$$T = \frac{V}{m} = \frac{\frac{(a+b)}{2}}{m} \times A$$

$$= \frac{\frac{a_2 + a_3}{2} + \frac{b_2 + b_3}{2}}{m} \times A$$

$$= \left(\frac{\frac{a_2}{4}}{m} + \frac{\frac{a_3}{4}}{m} + \frac{\frac{b_2}{4}}{m} + \frac{\frac{b_3}{4}}{m}\right) \times A$$

$$= 10\,(f_1 + f_2 + f_3 + f_4) \times A$$

$$= 10\,A\,\Sigma f$$

and

$$E = \frac{T\,(i_1 + i_2 + i_3 + i_4)}{10\,\Sigma f}.$$

Then, where we have a number of quadrilaterals, as shown in Fig. 3, we may estimate the total tonnage and its value by summation of the tonnage and value of each quadrilateral, or, perhaps more readily by the formulas:

$$T = 10\,\frac{\Sigma f}{n f} \times A,$$

in which A may be determined by planimeter; and

$$E = T\,\frac{\Sigma i}{10\,\Sigma f}.$$

Computations for the coefficient i may be well made with the slide rule, reading the coefficient f directly from a chart, prepared in the office. It will be found effective to color each quadrilateral in the stope map some tint representing the average value of that block of ore, and the amount of ore in the block may also be written on it.

I have found that the scheme here proposed affords quicker and clearer information as to the exact conditions existing in a stope than any other scheme that has come to my notice.

Washington Geological Survey

The Geological Survey of the State of Washington was established by law in 1901. During the years 1901-3 much useful work was done, particularly in connection with the preparation and publication of the annual reports for 1901 and 1902, respectively. That for the former year was in six parts, containing: (1) Outline of the geology of Washington; (2) metalliferous resources (except iron); (3) non-metalliferous resources (except coal); (4) iron ores and coal deposits; (5) water resources; (6) bibliography of literature relating to the geology of Washington. Vol. 2, 1902, contained: (1) Building and ornamental stones; and (2) coal deposits of Washington. Thereafter the State survey was inactive until 1909, when its work was resumed. For the current biennial period, April 1, 1911-1913, the State has made an appropriation of $57,500.

The Survey is working largely along economic lines, but giving especial attention to coal more than to other minerals. The publication of a number of bulletins was undertaken. Those on the "Geology and Ore Deposits of Republic Mining District," and the "Road Materials of Washington," are already published. One on the "Geology and Ore Deposits of Blewett Mining District, Chelan County," and another on the "Geology and Ore Deposits of Myers Creek and Oroville-Nighthawk Districts, Okanogan County," are in the press, while the following are in course of preparation: (1) "Coalfields of King County"; (2) "Cement Materials of Washington"; (3) "Geology and Ore Deposits of Index Mining District, Snohomish County"; (4) "Analyses and Fuel Values of Coal from Washington Mines"; and (5) "Underground Water of the Coalfields of Washington." The bulletin on the "Cement Materials of Washington" will supply an urgent need for information on this subject, for the cement-manufacturing works at present in existence in this State are unable to meet even the local demand for cement.

A progress map, 1909-1911, issued by the State survey, shows the area contained in quadrangles surveyed by the U. S. Geological Survey prior to 1909; also those surveyed under co-operation in 1909-1911. Completed surveys of coalfields, and of metal-mining districts, together with soil surveys of logged-off lands and areas covered by water-power reports, and the deposits of various materials, etc., are indicated on this map.

Preparations are being made for the publication, early next year, of a bulletin to be entitled "The Mineral Resources of Washington," which will contain detailed information relative to the plants of developed mines, both metallic and nonmetallic, and much other data concerning the mineral industry of the State. Thereafter, the publication will become an annual one, giving particulars of new developments of mines, quarries, etc., together with statistics of mineral production. Reliable data of this nature were not easily obtainable under the conditions that existed in the past, so its publication under official auspices will be welcome. So far as the coal-mining industry of the State is concerned, the State inspector of coal mines for years made his biennial report, which was printed, but no regular publication of other official mining information was kept by the State. Of course, there were from time to time publications by the United States Geological Survey relating to the State.

The Board of Geological Survey consists of Governor M. E. Hay, chairman; State Treasurer J. G. Lewis, secretary; President T. F. Kane, University of Washington, and President E. A. Bryan, State College of Washington. Prof. Henry Landes is state geologist, and Prof. Solon Shedd, assistant state geologist.

The Cleveland Cliffs Iron Company has established a mine-rescue station on the Marquette range, in Michigan. A supply of oxygen helmets has been purchased, as have a number of large tanks which will be kept charged with oxygen, and picked crews of men at the various mines are being trained to the use of the apparatus. An interesting supplemental device is a "pulmotor," to revive persons overcome by gas or smoke. It is expected that the example of the company will be followed by some of the more important Lake Superior iron-mining operators.

First Aid to Mining Machinery—II

By Henry M. Lane*

A description of the construction and operation of a small cupola for melting iron for casting; notes on the selection of melting mixtures and influence of various constituents upon the quality of the iron.

*Editor, *Castings*, Caxton building, Cleveland, Ohio.

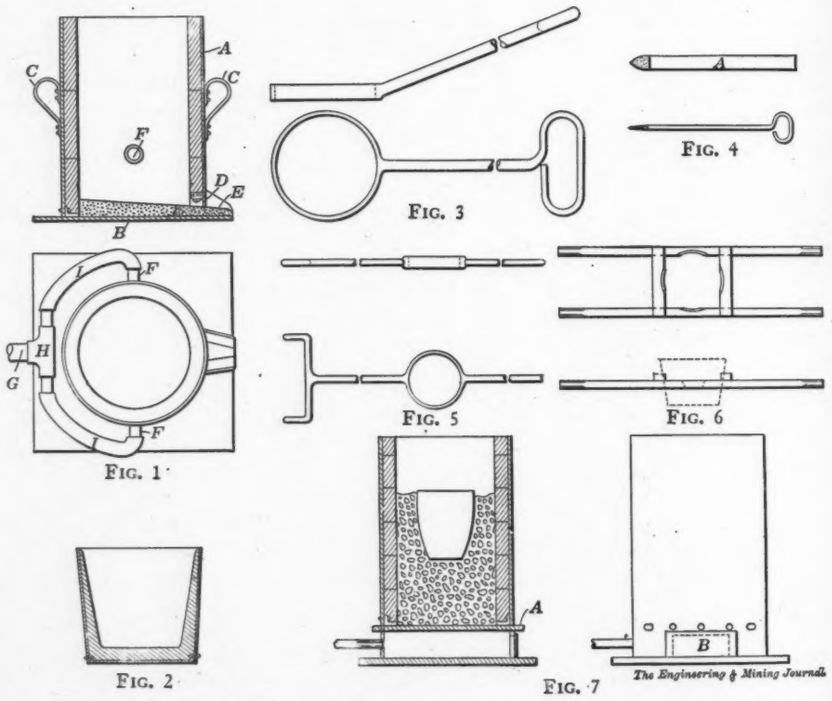
The melting of iron is not so difficult a task as many imagine. The principle to be borne in mind is to be careful in the selection of the stock and then to prevent its injury by additions of sulphur or by undue oxidation. Iron may be melted by two different methods: first, by the crucible method, which is only suitable for small quantities, and is exceedingly expensive both in fuel consumption and wear and tear on crucibles. The second method, that usually employed, is to melt the metal in contact with the fuel. A furnace of this kind has about the highest thermal efficiency of any metallurgical furnace fired with carbonaceous fuel. Of course small furnaces used in emergency work are not so efficient as the large standard melting equipments, but they are still far more efficient than crucibles.

A Cupola for Emergency Work

The cupola furnace, which is the type in which the metal is in contact with the fuel, will be described first. The fuel used in these furnaces must be high in carbon, low in ash, and free from sulphur. Anthracite coal answers the purpose very well. Coke, if it does not contain over 1 per cent. sulphur, will do admirable melting, and where neither of these can be obtained, charcoal may be used. A cupola of the simplest form for emergency work is shown in Fig. 1. It consists of a steel shell *A*, about 30 in. diameter and 36 to 40 in. high. This shell rests on a plate *B* which may be made of any convenient material. I have seen brick, stone, steel plates and cast-iron plates used for this purpose.

In the cupola shown, an angle iron has been riveted around the inside of the shell to support the brick lining. The shell is also provided with two handles *C C* which are used in lifting it about during lining or in removing it from the bottom after the run is completed. To prepare for a run the shell is lined with firebrick if they are available, and, if not, with a mixture of clay and sand. Fireclay is preferable for this purpose, but I have seen common adobe clay used.

After the shell is lined it is dried by a wood fire and any cracks are then repaired with clay mixed to the consistency of mortar, after which the lining is again dried. At the front of the shell there is an opening *D* through which the metal is tapped. This consists of a notch in the shell about four inches square. A corresponding opening is left in the brick work. After the shell has been lined it is lowered on the bottom plate as shown and a sand bottom rammed in. The bottom in the cupola proper can be made of ordinary green molding-sand tamped in about as hard as it would be for a green-sand mold.



Cupola, Crucible Furnace and Apparatus for Carrying Molten Iron

At the front of the furnace, which is known as the breast, a tapping spout is made, as shown at *E*. The tapping spout can be made of fireclay and sand mixed together, tamped in and dried by building a small wood fire upon it, using shavings and small chips. The breast or spout material is allowed to project into the interior of the hearth a little so as to prevent cutting of the bed or bottom just inside the tapping hole. In forming the tapping hole a stick about ¾ in. diameter is laid on the spout and the clay and sand mixture tamped about it. Some foundrymen do not put in the breast and make the tapping hole until after the fire has been started, but as a general rule in the case of emergency cupolas it is best to make it up first. If the bed material is made of molding sand not too damp it will dry out sufficiently during the firing up of the furnace and will give no trouble. Sometimes it is best to make the bed of fairly dry sharp sand, and then sprinkle the surface with clay wash.

There are two round openings in the sides of the shell as shown at *F F* and to these openings are attached short pieces of pipe to serve as tuyeres. In the illustration the blast is brought through the pipe *G* to the elbow *H*, from which it is conducted to the tuyeres *F F*, through the two pieces of hose *I I*. This hose may be made of rubber or canvas. A canvas hose is generally preferred and can be tied to the ends of the tuyere pipes *F F*, and if anything should go wrong so that is desired to open one of the tuyeres the canvas can be slipped from the tuyere pipe, giving immediate access to the interior of the furnace through the tuyere. The hole through the lining should be tapered so that the tuyere has a larger area on the inside than next to the shell. With a small cupola of this type a blast pressure of three or four ounces will be sufficient.

As the hight of the shaft increases the pressure should be increased until at elevations less than 2000 ft. above the sea level a pressure of 10 or 12 oz. would be required for cupolas in which the distance between the tuyeres and the charging floor is 12 ft. or more. Some advocate a higher blast pressure, but if the tuyere area is ample it is not necessary. For elevations of over 2000 ft. higher pressures are required. The blast may be furnished by any convenient means. If an air compressor is in use at the plant a connection may be made to the pipe *G* and a small quantity of air introduced into the pipe *G* from the regular air line, the pressure being reduced from the 60 or 70 lb. existing in the air line to the few ounces required, by throttling the flow at the valve. If the mine is not equipped with an air compressor the blast may be supplied by the blacksmith's bellows or blacksmith's fan. The tuyeres should be six or eight inches above the bottom of the furnace for ordinary work, as this allows the accumulation of 100 lb. or more of metal in the furnace.

The spout should be so formed that the metal in flowing from it will not come in contact with the edge of the plate *B* or it will melt the plate. The plate *B* should be supported on masonry or any other convenient support which will hold it high enough above the floor to permit a ladle to be set under the spout.

Blowing In the Cupola

In starting a heat a wood fire is built in the furnace, the hose pipes *I I* being removed from the tuyeres *F F*, the tapping hole *D* being left open. As soon as the wood is well kindled the fuel to be used is introduced and allowed to burn through until it appears red on top. The bed of incandescent fuel should extend at least a foot above the top of the tuyeres and it is better to have it extend 14 to 18 in. above before any metal is introduced. The greater the blast pressure the higher must be the bed.

After the bed is heated through, some of the metal to be melted is placed on it and then covered with another layer of fuel, after which another layer of metal is added and so on until the furnace is full.

The layers of fuel between the charges should not be over four inches in thickness. Each charge of fuel added can be depended upon to melt eight times its weight of metal in a furnace of this kind, and by weighing an amount of fuel equal to a layer four inches thick in the cupola and then multiplying this by 8, the weight of the metal charges can be obtained. Some advocate placing more metal on the bed than on the succeeding charges, but this is not good practice. In large cupolas it is proper to multiply by 10, and a thicker layer of fuel may be used.

The fuel in the bed performs two functions: it acts as a staging or scaffolding to support the metal to be melted, and that part of it above the tuyeres is burned by air introduced at the tuyeres thus producing the heat to do the melting.

Usually the tap hole *D* is left open after the metal is charged until the first 50 or 60 lb. of iron flow out, then the tap hole is stopped. This is necessary to warm the bottom. After the metal has been charged, together with succeeding layers of fuel, the furnace should be left for half an hour or more to allow the metal on the bed to become heated through and the fuel on the succeeding layers to become ignited. The tuyeres may then be connected to the blast pipe by means of the hose, and the air blast be turned on. The hottest point will be at what is known as the melting zone. This varies from 12 to 20 in. above the tuyeres. In a small cupola of this type using a blast of only 3 or 4 oz. the melting zone is sometimes only 8 or 10 in. above the tuyeres, but usually it will be at least a foot. The lining will have a tendency to burn out more rapidly at the melting zone and an examination of the lining after one or two heats will give a close idea as to the location of the melting zone.

Sometimes a short cupola like that shown in Fig. 1 does not have sufficient draft to cause the fire to start rapidly and in such case it may be necessary to let a small amount of blast in through the tuyeres from the time the coke is well ignited and to begin to blow the charge with the full blast as soon as all the iron is in. In such a case it is necessary to have the top of the bed one or two inches higher when the iron is charged than would be the case where natural draft is depended upon. By judicious use of the blast in starting the fire the time from lighting the fire until the first iron is melted can be greatly reduced.

Operating the Cupola

When the iron begins to flow from the spout it is allowed to run on to the floor until from 40 to 60 lb. have passed out, after which the spout should be stopped with a "bot" made from a mixture of sand and clay formed into a ball as dry as it can be worked. This is placed on the end of what is known as a bot stick. For emergency work the bot stick is generally made of wood as shown in Fig. 4. The bot of sand and clay on the end should be formed into a point as shown. In introducing this into the stream the point of the bot should be brought just above the stream close to the tapping hole and it should then be carried down and forward by a quick movement which will ram the sand into and through the tapping hole, thus effectually stopping it and filling the hole with sand.

After the cupola has been stopped the blast should be continued for a few minutes and then the stopping cut away with a tapping bar like that shown at *B*, Fig. 4. The end of the bar is drawn down to a square point. Some prefer to use a chisel-shaped point, but either is satisfactory. The sand should be picked away from the hole carefully until it is practically all removed when the tapping rod should be run through the hole and drawn out quickly. The metal will immediately flow and can be caught in the ladle. As soon as the metal ceases to flow the tapping hole should be stopped once more. The stream of metal can be cut off at any time by stopping the tapping hole with a bot.

In a cupola of this size there should be no difficulty in melting the metal at a high enough temperature so that it can be held in a large ladle until 200 or 300 lb. have been tapped out, and, in fact, in a cupola of 20 in. diameter on the inside and 40 in. high, I have seen 400 lb. of metal melted and tapped into two ladles and a 350-lb. casting made from them.

As the melting continues and each charge is completely melted the fuel above it comes down to replenish the bed and allows the next succeeding charge to gradually settle into the melting zone. As the charges settle additional material may be charged, keeping the cupola full at all times. To hold the heat down some prefer to put a shovelful of damp coke dust or charcoal dust on top of the cupola when it has been charged full. A cupola of this size can be kept in blast for an hour or more and in that case 1000 lb. or more of metal can be passed through it.

Blowing Out the Cupola

After all of the metal has been melted a pair of bars can be stuck through the handles *C C* and the whole shell lining and all be lifted from the bottom and set to one side to cool. The unburned portion of the coke and any slag or dirt which may remain in the cupola are raked off on the floor and extinguished by throwing water over them. Sometimes a cupola of this kind is made in two or more sections placed one above the other and after the heat they are removed in succession.

A small portable cupola used as an auxiliary in a gray-iron foundry is shown in the accompanying halftone. One of this style would be suitable for use in a mining camp. In this case the bottom is provided with a drop door hung on a hinge at the back and arranged with a latch at the front. Before beginning the heat the bottom door is latched into place and the bed made up with sand. After the heat is completed the latch is knocked to one side, the bot-

tom door allowed to fall, and this in turn allows any coke, slag, or unmelted iron remaining in the cupola to fall to the floor. This cupola is also provided with a cast-iron spout lined with clay and arranged as shown in the illustration. The shell of the cupola is in two sections, the upper one being arranged to lift off for relining, cleaning, or to enable the melter to make up the bottom of the cupola.

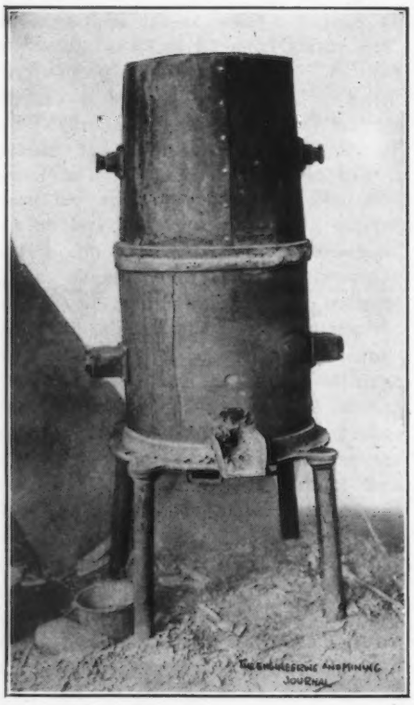
If much melting is to be done, of course it is well to buy a small portable cupola such as is furnished by the regular foundry-supply houses, but for emergency work any kind of a shell that is capable of supporting a lining may be used. I have been told of cases in which old gasolene or kerosene drums have been used for this purpose, and have known of one case in which a wooden barrel was used, the barrel being used simply to form a clay pot. The barrel was then burned away while drying the clay and the whole arrangement strengthened by placing some sheet tin over the outside and winding wire about it. This certainly is the crudest kind of a furnace, but it was said that it was successful in melting several hundred pounds of metal.

Ladle for Carrying Molten Metal

For carrying the metal from the cupola to the molds some form of ladle must be provided. A cross-section of a convenient form is shown in Fig. 2. It consists of a steel shell lined with a mixture of fireclay and sand, the lining being dried in place first by air drying and then by building a wood fire inside the ladle. All ladles should be heated by a wood fire before metal is tapped into them, and particular care should be exercised to see that at no time is melted metal allowed to flow over damp sand. If the sand beneath the cupola spout is damp when the metal flows out the water under the metal will be instantly converted into steam and will result in a terrific explosion. In like manner if the lining in the ladle is damp both lining and the metal may be blown out with disastrous results.

For carrying ladles some kind of a shank is necessary. Small hand ladles holding up to 40 or 50 lb. of iron may be carried in the single-hand shank shown in Fig. 3, while larger ladles will have to be carried in the double-hand shank shown in Fig. 5. This shank is shown with one straight end and one forked end, which is the best arrangement, as it enables one man to control the pouring while the man on the opposite end simply supports his measure of the load. The ladles are made tapered and should fit into the shanks for about two-thirds their depth. Sometimes a metal hook is arranged to pass from the shank over the back edge of the ladle, but if the ladle is set two-thirds of its depth into the shank there is little danger of its ever falling out.

In at least one case I have known of ladles carrying 200 lb. of metal each being supported in wooden shanks constructed as shown in Fig. 6. I have known of old powder cans being converted into ladles, and, in fact, almost anything made of sheet metal can be utilized if it is necessary, but if possible the stock from which a ladle to hold 60 lb. or less of metal is made should not be less than 1/16 in. thick, while the sheet stock from which ladles for holding 150 to 200 lb. of metal are made should be at least ⅛ in. thick. The capacity of any ladle can be calculated quickly by



A Portable Cupola with Drop Bottom

reckoning 4 cu.in. as representing one pound, which in the case of molten metal will be fairly accurate.

Fluxes and Fuels

Small emergency cupolas such as are herein described require no fluxing. Larger cupolas, however, should be fluxed with limestone or fluorspar. If the metal is to be held in the ladle for some time it should be covered with fine charcoal (lumps up to the size of a hickory nut). The fuel for use in a small cupola of the size described should be broken so that the pieces average about as large as a goose egg. For larger cupolas it is not necessary to break the coke or charcoal.

In small cupolas it is usually better to use coke than any other fuel, on account of the fact that all of the bed below the tuyeres takes no part in the melting, but simply acts as a staging for supporting the metal above, and where anthracite coal is used the discarding of this bed at the end of the heat is the cause of considerable waste. Charcoal is so much more bulky than coke for a given heating value that it is difficult to get enough stock into a small cupola to carry on a successful melting, and, in fact, it is generally necessary to make an emergency cupola considerably higher when employing charcoal.

Burning Charcoal

Charcoal is the best when purity is considered, as it is freer from sulphur and also from ash than any other fuel. A supply of charcoal can be made in any place where wood is available by cutting the wood into pieces about three feet in length, piling it in a close pile of from one to three cords, and then covering it with sod and clay, leaving one or more small openings at the top and two or three near the bottom. Fire is then started at the openings near the bottom and allowed to burn until the mass inside the pile is well ignited. The draft at the lower openings is then gradually checked and the upper openings partially closed until the mass is thoroughly charred. The openings at the top are finally closed and lastly those at the bottom.

If the covering is tight the charcoal may be left to cool in the kiln and will do so without burning; but should the covering leak, enough air may enter to burn a considerable portion of the coal, so that some prefer to rake the heap open when it is thoroughly burned and extinguish it by throwing water over it. This has one marked disadvantage, and that is that it introduces a large quantity of moisture into the charcoal, and so reduces its thermal efficiency. The condition of the burning heap can be ascertained at any time by thrusting a pointed iron rod through the pile. If it comes in contact with unburned wood the process is not complete, but if no wood is encountered the material is thoroughly burned and the pile is ready to be closed and allowed to cool.

Composition of Cast Irons

In selecting the material for making any given casting a knowledge of the different classes of iron contained in various castings is necessary. Ordinary cast iron contains scarcely more than 94 per cent. iron, the remainder being carbon varying from 3 to 4 per cent., silicon from 1 to 3 per cent., manganese from 0.3 to 1 per cent., phosphorus from 0.3 to 1 per cent., sulphur under 0.1 per cent.

The carbon occurs in cast iron in two forms, known respectively as combined and graphitic carbon. When the carbon is in the combined form it is united with

the iron in the form of iron carbide and this makes the metal hard, white and brittle. In the face of chilled car wheels the carbon is practically all in the combined form.

The graphitic carbon is present as flakes of graphite mechanically mixed with other constituents of the metal. The percentage of graphitic carbon and the arrangement of the grains affect to a large extent the hardness of the casting. In all soft, gray cast iron most of the carbon is present in the graphitic form. If castings are to be machined most of the carbon must be present as graphite. Slow cooling and the presence of a large percentage of silicon tend to throw the carbon into the graphitic form. Sulphur tends to throw the carbon into the combined form. Manganese in itself tends to harden iron, but has an even more marked tendency to unite with sulphur to form manganese sulphide which tends to rise to the surface of the metal and escape with the slag, or, in any event, renders the sulphur less harmful than when it is combined with the iron. For this reason the presence of manganese up to 0.7 per cent. is advantageous in castings. With ordinary sulphur percentages if the manganese is higher than this it has a tendency to harden iron.

Selecting Scrap Iron for Melting

When pig iron is used as a source of supply for the cupola it is necessary to know its chemical composition, but in the case of emergency casting work the usual source of metal is the scrap pile, and hence a knowledge of the best way to sort and select scrap is of importance. The faces of chilled rolls and car wheels are hard and white because the metal they contain has been cast against a chill, and it is of such a nature that this treatment will keep the carbon in the combined form. Remelting chilled car wheels and casting them into sand molds will produce castings that are fairly soft, though the car-wheel mixture is always fairly tough and hard. The remelting and slow cooling give the carbon that was in the combined form in the chilled faces a chance to separate as graphitic carbon. Car-wheel iron is exceedingly strong and hence makes a good base for any ordinary machine parts to be made from cast iron. If a small amount of electric-furnace ferrosilicon containing 50 per cent. silicon is added in the ladle it will tend to make soft castings from car-wheel scrap or any other similar high-carbon hard mixture.

Car wheels are usually quite low in silicon and this is also true of heavy work such as engine flywheels, large rolls or anything over two inches thick. Much of this will run under 1 per cent. in silicon. Ordinary machinery castings will run higher and stove plate will run close to 3 per cent. in silicon. A good grade of thin stove plate which has not been burned will melt down and cast into a soft gray casting and for this reason unburned stove plate may be used as a softener in iron mixtures.

Effect of Various Ingredients on the Castings

Each melting will tend to harden the iron by burning out some of the silicon and slightly oxidizing the iron. If the desired casting is, for instance, to be 1½ in. thick and 1 in. scrap is selected of the hardness desired in the 1½-in. casting, about the desired degree of hardness in the final casting will be obtained. The thickness of the metal is affected by the rate of cooling, and, as has been stated, slow cooling, like a high percentage of silicon, tends to throw the carbon into the graphitic form. If iron could be melted without reducing its silicon content the proper degree of hardness in a casting would be obtained by selecting scrap of the thickness required and of the hardness required, but since the silicon is reduced it is necessary to select iron of the hardness required and of a thinner section than the desired casting. The same results may be obtained by selecting iron of the desired thickness and hardness and then adding from a half to one pound of powdered 50 per cent. ferrosilicon to each 100-pound ladle.

A small amount of powdered 80 per cent. ferromanganese is also good material to introduce into the ladle, as it tends to clean the iron of sulphur and so produce soft castings. Burnt iron, such as burnt grate bars or burnt stove plates, should never be used in any castings that are to be machined, as the black oxide of iron which it contains is soluble in molten iron and renders it hard and brittle. The small cupola furnace will not reduce this oxide to metal.

Annealed malleable scrap should be avoided as this is practically wrought iron containing mechanically mixed carbon, and in most cases the cupola will not thoroughly re-incorporate the carbon with the metal. In large cupolas where so-called semi-steel is to be made, annealed malleable scrap may be used together with wrought-iron or steel scrap. The object of using scrap of this kind is to dilute the silicon and to some extent the carbon in the metal and so make a tougher casting.

It is impossible to melt metal in contact with the fuel and have it come out with much less than 3 per cent. carbon. If metal containing a smaller amount of carbon is charged it will absorb carbon in passing through the cupola. I have seen pieces of steel rails melted in a small cupula like that shown in Fig. 1, but in two meltings they took up nearly 3 per cent. carbon.

Agricultural machinery contains considerable gray iron which forms excellent scrap for the emergency cupola. Any scrap that will break readily under the hammer and show a gray fracture and file easily is suitable for the emergency cupola. If the metal has been galvanized or tinned it is just as good for the cupola as the zinc used in the galvanizing process will be vaporized and driven off and the tin will be partly driven off and partly alloyed with the iron. Tin does not injure iron but, if anything, renders it slightly more fluid.

When castings with a hard or chilled face are required it is necessary to use a chilling iron and to cast the metal against an iron chill; in other words, a portion of the mold must be made of iron. These chills can be made of ordinary gray iron and should be at least three inches thick. For a chilling mixture car-wheel scrap or chilled-die scrap should be taken.

There is considerable scrap around a mine in these days which is composed of special alloy metal, as, for instance, manganese or chrome steel and other similar hard alloys. These cannot be melted successfully in the emergency cupola.

Making Chilled Castings

Where reference has been made to car wheels in this article, the standard chilled-face cast-iron railroad-car wheel is the one in mind. There are now on the market steel car wheels the material of which cannot be successfully melted in the small cupola and many of the small mine-car wheels are made from nonchilling mixtures or mixtures that chill but slightly. As a rule chilled work is much harder to make than gray iron, and it is usually best to use dry-sand molds when dealing with chilled work and to warm the chills before pouring the metal into the mold. The object in warming the chill is twofold: it prevents the presence of moisture on the face of the chill, and prevents the too sudden setting of the metal when it first strikes the chill, which would result in rough spots or folds in the iron, commonly called "cold-shuts." The chills are warmed to about 200 or 300 deg. F. and sometimes not much above 100 or 120 deg. F. Where chills are used in green-sand molds without warming the chills the face of the chill should be rubbed over lightly with ordinary machine oil and as much as possible of the oil rubbed off with a piece of waste. This thin film of oil prevents moisture condensing on the face of the chill. In no case should the chill be colder than the body of sand which composes the mold. Care should also be taken to see that the face of the chill is not rusty, for rust would cause the metal to blow and ruin the casting.

Pouring the Molds

After the metal has been tapped from the furnace into the ladle, more or less slag will rise to the surface and this should be skimmed off before pouring or should be held back from the lip of the ladle with a skimmer made of a piece of steel rod. Sometimes the slag which rises to the surface is not easily skimmed back, and in such a case a small handful of dry sand may be thrown over the surface of the metal and this will bind the slag together and make it possible to skim it easily. As already stated, the metal should be covered with powdered charcoal if it is to be kept in the ladle any length of time, but for ordinary small work and for ladles up to a couple of hundred pounds it is not necessary.

When pouring the mold the metal should be poured in a steady stream and at such a rate as to keep the sprue full so as to prevent the washing of slag or other impurities down the sprue. Those who are not accustomed to pouring will generally succeed better with the double-shank ladle than with the single-shank or hand ladle. The castings should be left in the sand until the metal is thoroughly set and they will be softer if left in the sand until cool. This, however, has a tendency to burn the sand pile thoroughly, so that some foundrymen prefer to shake them out while redhot.

Where wooden flasks and particularly flasks having bars to help support the sand, are used, it is well to take off the flasks soon after the metal is set, but to leave the casting buried in the sand until it has cooled or at least become black.

Crucible Melting

As has already been stated, iron may be melted in a crucible. This method, however, is usually employed for melting brass or bronze. The style of furnace that is suitable for melting brass or bronze or for melting iron is shown in Fig. 7. At the left the furnace is shown in section and at the right in front view. It consists simply of a sheet-metal shell which is lined with firebrick or a mixture of fireclay and sand as was the case in the cupola shown in Fig. 1. The grate consists of a number of iron bars *A* passed through holes in the front and back walls of the shell. Underneath this is a space five or six inches in hight from which the ashes may be raked out through an opening at the front as shown at *B*. This opening is ordinarily closed with some kind of a door and the blast of two or three ounces introduced under the grate through a pipe shown at the back. The fuel generally used is coke, though either charcoal or anthracite coal may be employed. The crucible is placed on a bed of coke surrounded by fuel as shown. The top of the furnace when in use is partially covered with cast-iron plates or fireclay slabs.

Sometimes instead of using forced draft under the grate the products of combustion are taken out through an opening near the top of the shell and this opening is connected with a high stack, the natural draft being depended upon to cause rapid combustion. Graphite crucibles are used and when the metal is melted they are lifted out by special tongs and then handled in either single or double shanks.

(To be continued)

Broken Hill South Silver

The report of the Broken Hill South Silver Mining Company, for the six months ended June 30, 1911, shows 175,472 tons of ore mined, of which 170,032 tons was mined under contract, while 173,191 was conveyed to the shaft under contract. Development work amounted to 3437½ feet.

The work of the treatment plant at this Australian mine is shown in an accompanying table. The recovery of lead in the concentrates has been increased, and the amount of zinc lost decreased, as compared with the last two half-yearly periods; the improvement in the work of recovery of the zinky tailings is shown in another table.

During the period under review the Amalgamated Zinc (De Bavay's) company has taken all of the current tailings, and 16,271 tons from the dumps. The Zinc Corporation took 8991 tons of the old tailings dump. There is still on hand 1,058,281 tons of mill tailings (for the Zinc Corporation) and 115,355 of old zinc tailings (De Bavay's) and 261,692 tons of slimes, the last carrying 14.5 per cent. zinc, 5.7 oz. Ag., and 11.6 per cent. lead.

Costs were: Mining, $2.60; filling depleted stopes, $0.40; development, $0.31; concentrating, $0.86; total, $4.17 per ton of ore mined, or $25.39 per ton of concentrates produced. Profits, after providing 10 per cent. per annum depreciation, were £66,000, of which £60,000 was paid in dividends.

BROKEN HILL SOUTH SILVER MINING COMPANY

Ore Treatment Results

Product	Net Weight, Tons	Proportion	Assay Contents			Metal Contents			Proportion of Metal Contents		
			Per Ce't. Pb.	Oz. Ag.	Per Ce't. Zn.	Tons Pb.	Oz. Ag.	Tons Zn.	Per Cent. Ag.	Per Cent. Ag.	Per Cent. Zn.
Concentrates	26,617	15.2	71.6	23.2	5.2	19,058	617,514	1,392	75.0	54.2	5.8
Tailings—zinc	95,990	54.9	3.7	3.8	17.6	3,552	367,642	16,904	14.0	32.2	70.9
Tailings—quartz	29,420	16.8	2.0	1.7	9.0	589	50,671	2,659	2.2	4.4	11.1
Slimes	23,017	13.1	9.7	4.7	12.7	2,223	105,648	2,902	8.8	9.2	12.2
Totals	175,044	100.0	14.8	6.5	13.6	25,422	1,141,475	23,857	100.0	100.0	100.0

RECOVERY IN ZINKY TAILINGS

Period ended	Pb. Per Cent.	Ag. Per Cent.	Zn. Per Cent.
June 10, 1909	8.1	18.8	46.6
Dec. 31, 1909	11.8	24.2	59.7
June 30, 1910	12.2	25.2	63.8
Dec. 31, 1910	13.0	29.1	66.7
June 30, 1911	14.0	32.2	70.9

California Mineral Products in 1910

The compilation of statistical data embracing all mineral substances, except gold, silver and platinum, produced in California in 1910, has been completed by State Mineralogist Aubury. The approximate total value of all minerals produced in the year was $90,000,000, a gain of nearly $10,000,000 over 1909. Gains were made in asbestos, asphalt, bituminous rock, cement, chrome, gems, granite, infusorial earth, lead, limestone, magnesite, manganese, natural gas, petroleum, quicksilver, rubble, sandstone, soda, tungsten. The chief gains were: Cement, from $4,969,437 to $7,485,715; petroleum, from $32,398,187 to $37,689,542; natural gas, from $616,932 to $1,646,343. The total value of the minerals noted in the accompanying table for 1910 was $67,879,789, a gain of $6,246,942 over the previous year.

CALIFORNIA MINERAL PRODUCTION IN 1910

Asbestos, tons	200
Asphalt, tons	184,967
Barytes, tons	860
Bituminous rock, tons	87,547
Borax, tons	16,828
Brick, thousands	340,883
Cement, bbl.	5,453,193
Chrome, tons	749
Coal, tons	11,033
Copper, lb.	53,721,032
Feldspar, tons	760
Fuller's earth, tons	340
Gems, value	$237,475
Gypsum, tons	45,294
Glass sand, tons	9,124
Granite, cu.ft.	486,098
Infusorial earth, tons	1,843
Iron ore, tons	579
Lead, lb.	2,594,257
Lime, bbl.	479,507
Limestone, tons	684,635
Mineral paint, tons	200
Marble, cu.ft.	18,960
Macadam, tons	2,350,398
Magnesite, tons	16,570
Manganese, tons	265
Mineral water, gal.	2,335,259
Natural gas, 1000 cu.ft.	10,579,933
Paving blocks, 1000	4,434
Pottery clay, tons	249,028
Pyrites, tons	42,621
Petroleum, bbl.	77,697,568
Quartz sand, tons	10,100
Quicksilver, flasks	17,665
Rubble, tons	3,477,430
Salt, tons	174,920
Sandstone, cu.ft.	165,971
Slate, squares	1,000
Soapstone, tons	740
Soda, tons	8,125
Tungsten, value	$208,245

The Cheever Mines, Port Henry, N. Y.

By Guy C. Stoltz*

These mines were worked before the Revolution, and intermittently up to date. A corporation controlled by the Bethlehem Steel Corporation and Witherbee, Sherman & Co. is now completely modernizing them.

*Chief engineer, Witherbee, Sherman & Co., Mineville, N. Y.

The Cheever magnetite mines, near the village of Port Henry, Essex county, N. Y., and one-fourth mile east of Lake Champlain, are among the oldest of the iron mines of New York State. The ownership of the property, of late held by O. S. Presbrey, who was instrumental in restoring it to activity, has been taken over by the Bethlehem Steel Company, which controls 51 per cent. of the stock, and Witherbee, Sherman & Co., Inc., of Mineville, N. Y., controlling the remainder, under the title of the Cheever Iron Ore Company. H. S. Snyder, of South Bethlehem, Penn., is president of the new company, and A. E. Hodgkins, late of Witherbee, Sherman & Co., is general manager.

Historical

According to Professor Emmons' report on the second district, the ore deposits which were one time called the Walton or Old Crown Point lenses, were worked in 1785 and 1790. It has been stated by the late S. B. McKee, at one time engineer for the mines at Mineville, that the township of Moriah, in which Port Henry is situated, contributed iron for the work performed by Benedict Arnold in fitting out the fleet that fought the first great naval battle of the Revolutionary war, that of Valcour. The Cheever ore is supposed to have been transported down the lake to the Philip Skene forge, at Whitehall, N. Y. In Arnold's regimental book on June 13, 1775, he writes: "Sent a boat with Skene's negroes to dig ore at Cheever." Major Skene in 1771 was granted a patent for 600 acres at Cheever which was called Iron-Ore Tract. The tract was confiscated by the Americans and sold under an act of 1786. Lake Champlain ores are supposed to have been used in the furnaces at Pittsburg before those of Lake Superior. The mines have never been worked to capacity, and from 1893 to 1905 they were allowed to fill with water. Up to 1893 Smock reported 800,000 tons of ore as having been shipped, and this consisted almost entirely of lump ore running about 60 per cent. Fe and about 0.55 P. The high-grade ore in appearance and composition is similar to the Old Bed ore at Mineville, it is, however, generally lower in P.

Occurrence and Extent of Orebodies

The mines are based on a series of lenticular and pod-like deposits, which can be traced along the strike for nearly a mile, and extending beyond the Cheever property. The most southern of the orebodies outcrops about one-fourth mile from the shores of Lake Champlain, at approximately 300 ft. above the lake, the latter being 100 ft. above sea level.

These lenses, the Weldon and Tunnel Pit, dip to the southwest and lie approximately level, separated at times by only a few feet of barren gneiss. Both lenses have been worked along the dip for 1300 ft. The ore dips at 45 deg. at the outcrop, gradually flattens to a broad syncline, and at a distance of 700 ft. the foot wall occurs 15 ft. below the lake level, and following along the rising dip the ore occurs at the present working face, 50 ft. above the lake.

Tunnel Pit averages, perhaps, 50 ft. in width, with a variable hight of ore, eight to 12 ft. in some parts of the lens to 2 ft. along the present north-side limits. These pinches are being explored, and at times highten considerably.

The adjacent Weldon, which lies a little higher in horizon, averages 100 ft. in width, while the hight of ore has been much more regular, reaching 16 ft. at times. Recent developments have proved another lens of ore, separated from Weldon by about 10 ft. of barren gneiss, usually slightly higher in the ore-bearing horizon.

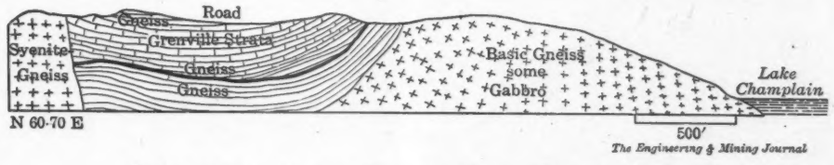
From the Weldon opening and 250 ft. to the northwest, is the continuous outcrop of the old Witherbee workings, covering approximately 60 acres. Diamond drilling within the 250-ft. limits has shown that the ore-bearing horizon between the two bodies carries irregular lenses of lean ore. The Witherbee workings dip steeply to the southwest, the pillars at the outcrop being 25 to 35 ft. high, while further along the dip the ore flattens as in the case of the first two lenses, to a wide synclinal basin 800 ft. from the outcrop, and then rises along the dip aided by a series of step faults averaging, perhaps, 5 ft. in hight.

A cross-section of the old workings is shown, the section being taken from Professor Kemp's report[1] of 1910 on the geology of Elizabethtown and Port Henry quadrangles. A cross-section in direction of the strike of the several lenses would be composed of five steps generally rising toward the northwest with Tunnel Pit and Weldon, New Weldon, 250-ft. lean area and Witherbee workings as the treads. These all occur in the 200-ft. thickness of ore-bearing rock but at different elevations.

Economic Geology

The orebodies occur in an acid gneiss or sometimes syenitic gneiss. This type of rock, with several unimportant exceptions, is found in connection with every magnetite iron mine in the Adirondacks, in southeastern New York and New Jersey.

In mining the rich ore a sharp contact is observed between ore and wall rock, occasionally a slip with serpentined sides will occur at the contact, but generally the ore dies out in regular planes, presenting no irregular fingers of ore extending into the walls, while the leaner portions of the lenses do not present definite contacts, for the ore content diminishes gradually. The walls for some distance on both sides of the pods contain some magnetite, but then only in small grains and thoroughly disseminated.



Cross-section of the Cheever Mine, Port Henry, N. Y.

Most of the magnetite is granular and basic, containing variable quantities of green to pink apatite with green pyroxene constitutents.

The ore-bearing acid to syenitic gneiss is fine grained, of close texture, light green-gray to red, and composed chiefly of the soda and potash feldspars with inclusions of albite, quartz in variable amount, green to black augite and hornblende. The pyroxenes and hornblendes are frequently altered to chlorite and sometimes serpentine, in altering the rock is often stained with red oxide of iron. Diamond drilling has shown that the iron-stained core occurs generally in

[1]Bull. 138, New York State Museum.

close proximity to the orebodies, both in the foot and hanging walls.

At a varying distance above and below the deposits the ore-bearing rock gives way to great thicknesses of a dark hornblendic gneiss. Usually the drill cores do not show the transition to be sharp or well defined, but a gradual diminution of several minerals and an increase in others until within several feet of the change from acid through the granitic phase to a decided hornblendic gneiss is complete. Usually below the ore-bearing gneiss and still below the hornblendic gneiss, masses of gabbro occur. To distinguish between the last two types megascopically is generally impossible, as both contain secondary garnet, and only thin sections, which, under the microscope, show a preponderance of pyroxenes, will determine the gabbro.

Those who favor the igneous origin of the ores at Mineville, six miles from Cheever, and particularly Professor Kemp who has made a careful study of these ores and who has spent some time on the Cheever property, treat the ore as basic segregations in the syenites. Kemp accounts for the several strata of Grenville limestone as being fragments caught up in a molten magma, and is convinced that the syenite-gneiss is intrusive because of the included Grenville and since the syenites present eruptive contacts with the anorthosites found elsewhere in the district, usually associated with titaniferous magnetites. He reasons that if the inclosing rock is igneous it carries eventually into the same group of rocks all the associated types of gneiss and even the ore itself. But again he grants deposits with jagged contacts, and this is not the case.

The formation has been generously faulted north and south, the throws in most cases being vertical and amounting to from four to ten feet.

Across the dip on the west of the Witherbee workings according to an accompanying cross-section the orebody is said to be cut off at the base of a small foothill of syenite-gneiss by the hill fault block. This part of the mine is now under water. Drives in several directions are said to have failed to find a continuation of the ore. It seems probable that the ore should be found again along the fault plane, particularly if the rock to the west is gneiss. Faults and dikes in the district and particularly at Mineville do not usually mean the end of an orebody but merely a change in situation.

First Gravity Plane

Weldon and Tunnel Shaft Houses

Infrequent narrow dikes of pegmatite, containing zircons cut across the formation in no regular direction, and effect no displacement of the orebodies.

Sedimentary Origin of Orebodies

The finding in outcrops and by diamond drilling of strata of crystallized limestone of Pre-cambrian age belonging to the Grenville series, 15 to 150 ft. above the magnetite and, perhaps, 200 ft. below, has strengthened the theory of sedimentary origin of the orebodies. At Mineville, N. Y., five miles to the north, drills have cut the limestone in several holes 250 ft. below the main orebodies and at Barton Hill mines this rock has been cored 1600 ft. below the main orebody.

Again, favoring this origin is the lenticular and sheet-like shape of the deposits, particularly the Witherbee mines, following in all cases the highly developed gneissoid banded structure of the walls.

the syenites or gneisses at Mineville as they now stand, do not represent sufficient normal syenite to have yielded the vast orebodies.

A series of tests were made upon the ore-bearing rock to learn the temperature at which the silica had crystallized, the results, Professor Kemp states, show a probable temperature of 575 deg. C., which would indicate that if not positively of igneous origin the crystallization took place at such a temperature as to preclude the mere burial and metamorphism of sediments, for this heat would need a depth of 11 miles to develop it. The enormous pressure due to folding, shearing and drawing out of the rock would develop high temperatures, and would not necessarily mean the rocks if sedimentary were buried so deeply.

It has been suggested that the ores may be the result of replacement, in a series of sedimentaries, but were this the case one would look for quite irregular

However, if the line of rock at the termination of the orebody is gabbro one would expect to find the orebody again to the west—on the west face of the intrusive.

Mining Methods

The ore is mined room-and-pillar fashion. The early mining methods were, in portions of the lenses, decidedly crude, and should be called room mining, for few pillars are found and large masses of heavy ground have been left on the back. Old stables underground and several whims, show that mules were used as power for the auxiliary hoists.

On the steeply dipping portions of the lenses the levels are driven on either side of the skipway, at 100-ft. intervals measured along the inclination of the hoistway, and the broken ore is pulled down the foot wall to the level tram track. Each level is widened and stoped up the foot wall until connection is made with the level above. The hanging wall usually

arches sufficiently so that a great percentage of ore need not be tied up in pillars, but in the wider portions they are left wherever support is required. Generally the ore is not mined clean on the hanging wall for the lime content in the rock when exposed is acted upon by air and the back will frequently require re-roofing. Occasional stulls and hand-packed ridges of lean ore or rock are placed at times to hold the back. The stull pieces are generously introduced along the sides of the hoistways. The tram cars, end dumping two ton capacity, and of Koppel design, are hand trammed on the levels to automatic tipples, the car discharging directly into the skip cars. To increase the capacity of each level a number of empties are stored on a switch from the main tram line and these are all filled and shoved to the tipple end of the main before the skip is signalled for the level. Two of the trammers are then detailed to unload the train of full cars and to stock the empty line. The empty cars weigh 1165 lb. and two men can handle the cars on a grade of 1¼ per cent.

On the flatter portions of the Witherbee workings the ore is trammed in end-dump cars to a storage pocket situated in a raise, made to these workings from a 300-ft. crosscut, driven from the Weldon mine. The ore will then be drawn off in W-bottom tram cars, which will be collected by an electric locomotive, trammed about 500 ft. and dumped by door trips, into a storage bin near the southeast face of the Weldon workings. The ore may then be taken to the surface by the Weldon or Tunnel Pit hoists. The main storage bin also receives the hand-trammed ore from the nearby levels in the Weldon and Tunnel mines. In the haulage system through the drift the three-phase system is installed two trolley wires are used, the rails acting as a part of the circuit. In addition to the drift outlet for the Witherbee ore a single-track skipway has been laid on the foot wall of the present workings. One vertical shaft 325 ft. deep, which was sunk to reach the Witherbee syncline, and another nearly vertical shaft 1600 ft. west of the outcrop, can be utilized if required to increase the capacity.

Concentrating Mills

The electromagnetic separating plant is now equipped to handle 700 tons of crude ore per day. It was originally designed by the Geo. V. Cresson Company. The mine run of ore is trammed from the head-frame storage, by Hunt Automatic railways equipped with two-ton W-bottom cars, and from the Witherbee headframe about 700 ft. down a trestled line, by Hunt cars which descend by gravity and are returned to the headhouse by a one-drum Lambert electric hoist.

Storage bins at the headframes and mill will receive over 1000 tons of crude ore. All ore as drawn from the storage bins through air-operated gates is weighed on a Fairbanks 50-ton track scales, the weight being automatically registered on tickets, by pulling a lever on the beam balance.

The mine run consisting of fines to 18-in. lumps as drawn from the mill bin is crushed to 2½ in. in a Buchanan jaw crusher, the whole is then elevated to a 2½-in. grizzly where the unders are sent to a Ball-Norton drum cobber operating under six amperes which removes concentrates, the tailings join the overs from the grizzly and go to a set of 30x14-in. Buchanan corrugated rolls set to one inch.

The crushed product is then elevated and screened to ½ in., the unders going to a belt separator working under seven amperes, where concentrates are removed and tails rejected. The oversize from the screens is fed to a Buchanan 30-in. diameter drum cobber, 7½ amp., where concentrates are removed. The tails from the cobber are recrushed in Buchanan 36x18-in. smooth rolls set at ¼ in., the product elevated to a trommel provided with 5/16-in. round holes, the undersize is split and delivered to two Ball-Norton belt separators operating with 6½ amp., the oversize is fed to 40x15-in. Anaconda smooth rolls. The rolls product is elevated back to the trommel. All concentrates and tails from the several separators are delivered to their respective conveying belts, the one for concentrates being 18 in. wide and 100 ft. long, while the tailings belt is of the same width and 90 ft. long.

The average iron content in the concentrates is 60 per cent., while the tailings will run as low as 6 to 8 per cent. The phosphorus in the heads will usually run 0.06 per cent. The concentrates and tailings are delivered to a second set of belt conveyers of the same width, running at almost right angles to the main belts. The sub-set delivers the two products to separate compartments in a storage bin, where the tails are drawn off in cars and hand trammed to the tailings pile, the concentrates being drawn off in 4½-ton Wonham & Magor V-bottom cars and trammed by gravity over two planes[2] one-half mile to chutes, feeding into gondolas on the Delaware & Hudson siding on the lake shore. Automatic-dump cars are to be used in handling the tailings, the load is to be run out by gravity and the empties will be drawn back to the bin by a small electric hoist.

Tenement House and Workmen's Cottages, Cheever Iron Mines

Power Plant

The management has recently scrapped the steam equipment, since it was inadequate for the increasing output of the mines, and too because of the high cost of power. A great saving has been effected by electrifying the entire plant, power being supplied by the Witherbee-Sherman 2400-kw. plant at Port Henry, N. Y.

Alternating three-phase current at 6600 volts and 25 cycles is carried over No. 6 B. & S. wire, strung on the ordinary wooden pole and crossarm. The high voltage is distributed over the entire works, each distributing point having its own step-down transformers, 6600 to 440 volts. At the present time the plant requires 2800 kilowatt-hours daily. There are two compressors, an Ingersoll-Rand 1400 cu.ft., and a Chi-

[2]"Automatic Railways at Cheever Mines," Eng. and Min. Journ., Sept. 3, 1910. "Gravity Planes at Cheever Mines," Eng. and Min. Journ., Oct. 15, 1910.

cago Pneumatic Tool Company of 2423 cu.ft. capacity, installed in a modern red-brick building, in which is also situated a thoroughly equipped machine shop. Air is compressed to 85 pounds pressure.

The Ingersoll-Rand, a class J-25¼x 16¼x16-in. machine, is belt connected to a General Electric synchronous motor, rated ATI 6-187 k.v.a.-5000 r.p.m.-6600 volts. The Chicago Pneumatic compressor is of the Franklin type, 28x17x26-in., driven direct connected by a 425-h.p. General Electric induction motor, rated at 136 r.p.m. and 6600 volts. Ingersoll-Rand, Chicago Pneumatic and Murphy (hand) drills are used.

The concentrating mill is driven by a 150-h.p. General Electric induction motor, rated 16-500-r.p.m., and 440-volt direct current for the electromagnetic separators is supplied by a Westinghouse generator, type S 20-kw., belt driven by a General Electric induction motor, rated 14-20 h.p., 750 r.p.m., 440 volts.

The Weldon and Tunnel Pit hoist is a two-drum Wellman-Seaver-Morgan machine, driven through a double-reduction gearing by a General Electric induction motor, rated ITC-225 intermittent h.p., at 480 r.p.m. and 440 volts. The drums are 60-in. diameter with a 36-in. face, and have a winding speed of 500 ft. per min. The Witherbee hoist is a Lambert double drum, driven through double-reduction gearing by a General Electric induction motor, rated ITC-75 intermittent h.p. at 470 r.p.m. and 440 volts. The drums are 42-in. diameter 36-in. face, and have a winding speed of 400 ft. per min. The surface hoists are housed in monolithic and concrete-block structures. Auxiliary underground hoists are Lidgerwood single drum, 42-in. diameter by 30-in. face, with a hoisting speed of 400 ft. per min. They are driven by induction motors, rated ITC-37 intermittent h.p., at 700 r.p.m. and 440 volts.

Cost of Unwatering

Under the new management the old Witherbee workings have been unwatered. It has been estimated that 77,028,000 gal. were handled at a cost per 1000 gal. of $0.0946. This includes cost of pumps, power used, labor of pumpmen, moving pumps, etc., in short, all costs pertaining to pumping. The unwatering installation consisted of two 5x6-in. vertical triplex Allentown Rolling Mill electrical pumps, with a capacity of 100 gal. per min. under 300-ft. head, geared to General Electric induction motors, rated at 16-12 A-500 r.p.m., 440 volts. In addition to the electric equipment, one steam pump, with a capacity of 100 gal. per min., was used about one-half of the pumping period, and another steam pump of 500 gal. capacity was in use about three weeks.

The company houses, single and two to eight compartment, have been repaired and painted and new concrete-block houses are being built as required. These blocks are made of portland cement and tailings from the mill dump, mixed 1 to 5, an 8x10x20-in. block costing approximately 10c. A large swamp near the mines is being filled with the mill tailings and over this it is planned to have a street of modern concrete-block houses erected. Exploration and development work is being carried on extensively. During the last summer magnetic surveys with dial compass and dip needle have been made under the direction of Professor Ingalsbee, of Lehigh, and topographical and geological maps of the company's property and adjoining lands are now being made.

A view gravity plane is under construction for conveying the mill concentrate to a storage pocket on the Delaware & Hudson railroad on the lake shore. This will do away with the two-plane gravity system now operated.

The company hopes soon to have the mines in shape to produce 1000 tons per day, and with this in view, plans are under way for installing additional concentrating machinery to the mill.

Slocan Star Mines, B. C.

By E. Jacobs*

The Slocan Star Mines, Ltd., which is to acquire and operate the Slocan Star and Rabbit Paw groups of mineral claims, situated near Sandon, Slocan district, British Columbia, is to have an authorized capital of $2,500,000 in shares of par value of $1 each. The terms under which the consolidation of the properties has been arranged provide for the allotment of 2,000,000 shares to the two companies interested, leaving 500,000 in the treasury of the new company. Of the latter, 100,000 are to be shortly offered for subscription at 50c. per share, payable in cash.

The mineral claims included in the consolidation are the Slocan Star, Jennie, Silversmith, Windsor and Shogo, of the Byron N. White Company's Slocan Star group, together with that company's mill and concentrating works, millsite and water records appurtenant thereto; and the Star Mining and Milling Company's Rabbit Paw, Heber fraction, Minnesota, Belladonna, Millie, Whistler fraction and Pembroke claims. All the claims included in the consolidation lie on the east side of Sandon creek. Ore extraction from several of these claims led to the Star vs. White litigation which extended over nine years and resulted in a judgment in favor of the plaintiff company. The vein on which the defendant claimed extra-lateral rights was declared by the plaintiff to consist of two distinct veins due to a fault near the westerly end of the Slocan Star mine; and the trespass was, therefore, not justified.

The property has been extensively developed on the Slocan Star, Silversmith and Heber fraction claims to a depth of 600 ft. During 12 years, 1894 to 1905, total shipments from the Slocan Star were as follows: Crude silver-lead ore, 17,870 tons, gross value $1,291,728; silver-lead concentrate, 15,594 tons, gross value, $1,229,641; zinc concentrate, 3455 tons, gross value, $154,061. Aggregate tonnage of products shipped was, therefore, 36,919 tons, and gross value, $2,675,430. In addition to paying all cost of development work, prospecting, erection of mine buildings, equipment of mine and concentrating mill, etc., a total of $542,600 was paid in dividends.

The issue of 100,000 shares of treasury stock above mentioned, is for the purpose of providing money to carry out a scheme of further development outlined by A. G. Larson, mining engineer, who lately made a thorough examination of the several properties. Mr. Larson recommends driving a crosscut tunnel about 2300 ft. to cut the Slocan Star vein, which would give an additional vertical depth of 400 ft., and 600 ft. on the dip of the vein, including drifting 200 ft. on the vein and raising to connect with the sixth level; the estimated cost would be about $40,000, which outlay would be in part offset by proceeds of ore meanwhile to be extracted from the upper levels of the mine. The proposed development would, if carried out, place the mine in such condition that it could thereafter be worked on a large and economical scale.

This consolidation will effectually remove all possibility of further extra-lateral rights litigation between the Star and Byron N. White companies, and insure the removal of the chief obstacle to a renewal of mining activity such as characterized the operations of the Byron N. White Company up to 1905. Since that year it has done little beyond prospecting and developing other claims than those affected by the long standing litigation. The Slocan district will be a substantial gainer by the resumption of important operations at the Slocan Star mine and concentrating mill.

*Victoria, British Columbia.

Mineral Production of Quebec

The mineral production of the province of Quebec for the year 1910 is officially reported as follows; the items being arranged in order of their values: Asbestos, 80,605 tons; limestone valued at $503,173; granite valued at $291,240; lime, 1,152,312 bushels; marble valued at $151,103; copper and sulphur ore, 24,025 tons; mica, 251,419 pounds. There were 7901 workmen employed and an aggregate of $3,152,753 was paid in wages.

NEW PUBLICATIONS

HANDBOOK FOR IRON FOUNDERS. 4x6½, pp. 155; 2s. Frondair Iron and Steel Company, Ltd., London.

THE THEORY AND PRACTICE OF TECHNICAL WRITING. By Samuel Chandler Earle. 5½x7¾, pp. 301, illustrated; $1.25. The Macmillan Company, New York.

BIGHORN COAL BASIN, ALBERTA. By G. S. Malloch. Pp. 74; illustrated. Memoir No. 9-E, Canada Department of Mines, Ottawa.

RESULTS OF SPIRIT LEVELING IN UTAH, 1897 TO 1909, INCLUSIVE. By R. B. Marshall. Pp. 38. *Bull.* 489, U. S. Geological Survey, Washington.

REPORT OF THE COLORADO STATE BUREAU OF MINES FOR THE YEARS 1909 AND 1910. Pp. 110. T. J. Dalzell, Commissioner of Mines, Denver.

PRELIMINARY REPORT ON THE CLAYS AND CLAY INDUSTRIES OF OKLAHOMA. L. C. Snider. Pp., 270. *Bull.* 7, Oklahoma Geological Survey, Norman.

WHITTAKER'S ELECTRICAL ENGINEER'S POCKET BOOK. Third Edition. Edited by Kenelm Edgcombe. 4x6½, pp. 597; $2. Whittaker & Co., London, England.

REPORT ON TANAMI GOLDFIELD AND DISTRICT. By Lionel C. E. Gee. Pp. 22; illustrated. R. E. E. Rogers, Government Printer, Adelaide, South Australia.

GEOLOGY AND MINERAL RESOURCES OF THE NAZINA DISTRICT, ALASKA. By Fred H. Moffit and Stephen R. Capps. Pp. 111. *Bull.* 448, U. S. Geological Survey, Washington.

MINERAL RESOURCES OF WYOMING AND THE MINING LAWS OF THE STATE AND THE UNITED STATES. Pp., 102. C. E. Jamison, State Geologist, Cheyenne, Wyoming.

GEOLOGY AND ORE DEPOSITS OF THE BLEWETT MINING DISTRICT. By Charles E. Weaver. Pp. 106, illus., cloth. *Bull.* 6 Washington Geological Survey, Olympia.

COAL, OIL AND GAS OF THE FOXBURG QUADRANGLE, PENNSYLVANIA. By Eugene Wesley Shaw and Malcomb J. Munn. Pp. 85. *Bull.* 454, U. S. Geological Survey, Washington.

WIE LIESSE SICH DAS EUROPAISCHE ERDGRAS BESSER VERWERTEN? By Johann Walter. 5½x8½, pp. 19; paper. From *Allgem. Osterr. Chemiker- und Techniker-Zeitung*, XXIX, No. 23.

ANNUAL REPORT OF THE MINISTER OF MINES OF BRITISH COLUMBIA, FOR THE YEAR ENDING DECEMBER 31, 1910. Pp. 269. Richard McBride, Minister of Mines, Victoria, B. C.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. LXXXIII, No. 1, 1911. Edited by George C. Lloyd, secretary. 5½x8½, pp. 753, illustrated. E. & F. Spon, Ltd., London.

WORKMEN'S INSURANCE AND COMPENSATION SYSTEMS IN EUROPE, Vol. II. Twenty-fourth Annual Report of the Commissioner of Labor, 1909. Pp. 2749. Department of Commerce and Labor, Washington.

A GEOLOGIC RECONNAISSANCE IN SOUTHEASTERN SEWARD PENINSULA AND THE NORTON BAY-NULATO REGION, ALASKA. By Philip S. Smith and H. M. Eakin. Pp., 146. *Bull.* 449, U. S. Geological Survey, Washington.

THE COPPER HANDBOOK, VOLUME X, 1910-1911. 6x9, pp. 1902; cloth, $5; Morocco, $7.50. Compiled and published by Horace J. Stevens, Houghton, Mich.

The tenth volume of this well known handbook has reached large dimensions, over 1900 pages being required by its contents. Of these pages 1646 are taken up by the descriptions of copper mines and notes on copper-mining companies, in which Mr. Stevens has not hesitated to comment freely—according to his usual custom, upon mine values and company methods. The growth of the work is shown by the fact that while Volume I listed and described 236 properties, the present volume gives notes on 8130 mines and companies. In addition to the list of companies, 100 pages are occupied by condensed notes on the copper deposits of the world. The introduction contains chapters on the history, metallurgy and uses of copper; all revised and brought up to date from the earlier issues. The volume is given the double date of 1910-11, because various accidents delayed its publication until the present time; so that it was considered best to make it cover the two years, and to allow time to make the revision as complete as possible. The "Copper Handbook" has made for itself a unique position, since no such body of information can be found elsewhere concerning mines and their owners. It is only by long continued and concentrated work that it has reached that position.

TWENTIETH ANNUAL REPORT OF THE ONTARIO BUREAU OF MINES, 1911, PART I. Pp. 301, paper, illustrated, with maps. L. K. Cameron, King's Printer, Toronto.

This report covers the year 1910, generally speaking, but in some cases includes information applying to later dates. It opens with a statistical review of the provincial mining industry, by Thomas W. Gibson, deputy minister of mines, embracing numerous tables showing the quantity and value of the output as compared with previous years. A report on mining accidents by E. J. Corkill, chief inspector of mines, furnishes statistics, and urges the appointment of technically trained men for responsible positions in mines as a preventive for accidents. Mr. Corkill also describes the mines of the province, except those of the Cobalt district. N. L. Bowen deals with silver in Thunder Bay district and contributes a paper on the salt industry. The goldfields of Lake of the Woods, Manitou and Dryden are described by Arthur L. Parsons, and the Vermillion Lake pyrite deposits and the Sturgeon Lake goldfield by E. S. Moore. Dr. Willet G. Miller, provincial geologist, contributes notes on a geological trip to Scotland; also, with Cyril S. Knight, a paper on the Laurentian system. Prof. M. B. Baker, of Queens University, Kingston, reports the result of an investigation of iron and lignite deposits in the Mattagami basin. S. Price, mining commissioner, presents an exposition of the mining law of Ontario with a historical sketch of previous legislation.

THE MINERAL INDUSTRY; ITS STATISTICS, TECHNOLOGY AND TRADE DURING 1910. Vol. XIX. Edited by Albert Hill Fay. 6x9, pp. 904, illustrated. $10. McGraw-Hill Book Company, New York.

The same general plan which marked the earlier editions of "The Mineral Industry" has been followed in the present volume; many contributors remain the same, and where one has dropped out, he has been replaced by another of equal standing.

Great credit should be given Mr. Fay for the promptness with which this volume has appeared, a feature which should make it the more sought by the engineer and economist, as it will probably be several months more before the various governments issue their official statistics. As usual, the book makes slight corrections and revisions in the statistics published in earlier volumes, to make them accord with the results of later data, so that for statistical work the last volume issued should be used.

Of current interest is the discussion by Herbert Lang, of the sulphur-smoke problem. Electrolytic copper refining is treated by A. L. Walker; the metallurgy by L. S. Austin; the metallurgy of iron by Bradley Stoughton; iron-ore supplies by J. F. Kemp and Dwight E. Woodbridge; lead smelting by H. O. Hofman; the metallurgy of zinc by W. R. Ingalls; precious stones by George F. Kunz; milling by Robert H. Richards and Charles E. Locke; cyanidation by C. H. Fulton; while shorter articles are contributed by such men as James Douglas, L. D. Ricketts, Herbert Haas and E. F. Roeber.

In general, the book bears out its name well, and it is difficult to see how anyone interested in either the economic or technical side of mining or metallurgy can get along without "The Mineral Industry."

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Alexander Leggat has returned to Butte, Mont., from Alaska, where he was all summer.

J. Cleveland Haas has returned to Spokane, Wash., from visiting mining districts in Oregon.

A. J. Hackstaff, president of the Golden Reward Mining Company, has been visiting the mines in South Dakota.

Milnor Roberts, dean of the School of Mines, University of Washington, Seattle, Washington, was in San Francisco lately.

John Gray, general manager of the Wasp No. 2 mines, South Dakota, has returned from a summer spent in Great Britain.

R. H. Channing, Jr., has been chosen president of the Utah Consolidated Copper Company in place of Urban H. Broughton, resigned.

J. H. Polhemus, Joplin, Mo., manager of the American Lead, Zinc and Smelting Company has gone to Tennessee to examine the company's mines there.

Hon. Robert Rogers, late Minister of Public Works for Manitoba, has accepted the position of Dominion Minister of the Interior, including the Department of Mines.

W. P. Gleason, general manager, and Dr. R. M. Mathias, general superintendent of the Illinois Steel Company, have been visiting the Mesabi iron range in Minnesota.

Frank Kennedy has resigned his position as chief engineer of the Shenango Furnace Company to accept a position in the faculty of engineering of the University of Wisconsin.

Myron K. Rodgers reached Seattle, Wash., the first of the month, on the return from a two month's trip during which he examined a number of mining properties in the Western States.

Arthur Lakes, Jr., of Denver, Colo., is now directing development operations at the Wilcox gold mine, near Ymir, Nelson mining division, British Columbia, for the Ymir-Wilcox Development Company.

C. D. Emmons, of Eugene, Ore., recent returned south after having spent several weeks on Graham island, of the Queen Charlotte group, British Columbia, in connection with drilling operations for oil.

Jennings S. Cox, Jr., general manager of the Spanish-American Iron Company, and Pedro Aguilera, a mining engineer of the company, were seized by bandits recently near Cuero, Cuba, but were later rescued.

Francis A. Thomson, head of the department of mining engineering at the State College at Pullman, Washington, was judge of mineral exhibits at the Interstate Fair held recently at Spokane, Washington.

George E. Farish, of New York and Denver, has been appointed manager of the Dobie and Tisdale companies, Porcupine, Ont., in place of Charles E. Watson, who has resigned to take charge of the Plenaurum mine.

M. E. Purcell, superintendent of the Consolidated Mining and Smelting Company of Canada's Center Star group at Rossland, B. C., spent part of this month at Spokane, Wash., and in the Cœur d'Alene, Idaho.

C. N. Nelson, late of Roberts & Nelson, San Javier, Sonora, Mexico, has accepted a position with the New York & Honduras Rosario Mining Company, and sailed from New York, Oct. 18, on his way to San Juancito, Honduras.

Hon. Frank Cochrane, Minister of Lands, Forests and Mines for Ontario, having resigned that position to become a member of the Dominion government at Ottawa, is succeeded by William H. Hearst, M. P. P. for Sault Ste. Marie.

Any reader knowing of the present address of Andrew Murphy, a prospector in Nevada and some other western State for a number of years, is requested to write to the JOURNAL. His sister, Mrs. Margaret Leonard, is anxious to find him.

Robert H. Morris, late superintendent for the Mexican Coal and Coke Company, is now superintendent for the Jasper Park Collieries, Ltd., which is opening coal mines at Pocahontas, Alberta, along the line of the Grand Trunk Pacific railway, 205 miles west of Edmonton.

P. B. McDonald has resigned as assistant engineer for the Munro Iron Mining Company at Iron River, Mich., to take charge of exploration work on the Marquette range for the Heidelbach banking interests of New York. His headquarters will be at Negaunee, Michigan.

George L. Fraser, manager of the Columbia Coal and Coke Company, opening a coal mine in the Tulameen district of British Columbia, has returned to that province after having visited the United States in connection with the purchase of machinery and plant for the Coalmont mine.

Roswell E. Sampson, who has been with the Quincy Copper Company, at Hancock, Mich., adapting the Richards pulsator jig and settling appliances to Quincy mill conditions, has been appointed instructor of metallurgy in the mining engineering department of the State College at Pullman, Washington.

M. S. Davys, managing director of the Silverton Mines, Ltd., operating the Hewitt-Lorna Doone group of mines, and the Wakefield concentrating mill, in the vicinity of Slocan Lake, B. C., has returned to England, after having spent some time in Slocan district with H. M. Ridge, of London, a specialist in the treatment of mixed ores.

Dr. Charles N. Gould has resigned as director of the Oklahoma Geological Survey in order to enter into private work and D. W. Ohern, professor of geology at the State University, has been appointed to the position. The new director plans to have ready for the public in the near future reports on the iron ores, lead and zinc, and the northeastern oil district.

OBITUARY

O. D. Kinney, formerly of Duluth, Minn., died at Athens, Penn., Oct. 11. He was largely interested in mines on the Mesabi iron range in Minnesota, and was widely known in that district.

Henry E. Bowns died in Brooklyn, N. Y., Oct. 10, aged 79 years. He had been a merchant in Brooklyn for many years, but in his early days was among the first settlers in California in 1849. For several years he was largely interested in mines in that State.

SOCIETIES and TECHNICAL SCHOOLS

Missouri School of Mines—The ceremonies attending the laying of the cornerstone of the new Parker Hall and the fortieth anniversary of the School of Mines and Metallurgy of the University of Missouri will be held, Oct. 24, at Rolla.

Mining Men's Club of Spokane—A dinner was held at Spokane, Wash., Oct. 4. Following the dinner, some interesting addresses were delivered. The visitors included Prof. R. S. McCaffery, Moscow, Idaho; M. E. Purcell, Rossland, B. C.; Dr. G. B. Smith, Anacortes, Wash.; E. Jacobs, Victoria, B. C., and others.

Society of Chemical Industry—A regular meeting of the New York Section was held Oct. 20, the following papers being presented:

"The Facilities for Industrial Research," by M. C. Whitaker. "The Antiseptic Effect of Creosote Oil and Other Oils Used for Preserving Timber," by John M. Weiss. "Manufacture and Performances of the Edison Storage Battery" (illustrated), by Howard Lyon.

American Institute of Mining Engineers—A meeting of members resident in eastern Washington and western Idaho was held at Spokane, Wash., Oct. 4. Prof. R. S. McCaffery, of Moscow, Idaho, was chosen chairman and L. K. Armstrong, of Spokane, secretary. After some discussion, a resolution was adopted favoring the organization of a local section of the institute. The chairman and secretary were instructed to obtain a formal authorization from the council of the institute. As soon as that is received a meeting will be called to organize the section.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

Oct. 12—No branch of the mining industry in California offers so small opportunity for promotion "boosting" as gold dredging, and none less capable of misrepresentation. No sane investor will expend money in the construction and installation of a dredge for the operation of ground that has not been thoroughly prospected and proved.

There has recently come to the light of publicity, however, unnecessary and unfair promotion schemes offered as inducement to the buyers of shares of the stock issued for development and operation. A particular instance is cited here for the reason that it affects unjustly not only public but private interests.

The Union Dredging Company shows in its prospectus a map purporting to be the sketch map of the American River district showing gravel beds and the formation as determined by C. M. Rolker, and published in the State Mining Bureau Bulletin, No. 57, on "Gold Dredging in California," written and compiled by W. B. Winston and Charles Janin. The bulletin map presents in one corner a list of dredges dismantled up to July 1, 1910, as well as a list of the dredges operating. In the reproduction by the Union Dredging Company promoter this list of dismantled dredges is omitted, and in its place is a sketch of the property of the dredging company in question. The impression made upon the investor is that the entire map in the prospectus is reproduced from the Mining Bureau bulletin. The evident inference would be that the authors of the bulletin and the delineator of the map had especially indorsed the company's dredging project.

[The use of the Mining Bureau map in the above manner was undoubtedly reprehensible. It was distinctly unethical from an engineer's point of view, but promoters are promoters and this sort of thing appeals to them as a clever stroke.

In this instance the cry comes rather late, however, as we happen to know that the stock of the company is practically all sold already; also that the management has been taken out of the original promoter's hands, arrangements having recently been made to pass control to one of the leading stockholders for the purpose of assuring a straightforward business-like management under competent technical direction.

An examination of the ground has been made and a 9-cu.ft. bucket dredge is now being constructed, and the regular output of gold from the property upon the completion of the dredge will probably attract far less attention than the methods of the promoter.—EDITOR.]

Denver

Oct. 10—An important meeting is to be held at the office of Governor Shafroth on Oct. 21, for the purpose of furthering a movement to secure an appropriation by Congress to establish at some point in this State an experimental plant to determine the best mechanical and chemical methods for the treatment of low-grade ores. Its work will be for the benefit of the whole State and the aid of the Bureau of Mines will be enlisted if possible. The mining men of the San Juan region, the home of great true-fissure veins and large low-grade orebodies, are active in this movement and will put forth the claim of Silverton as a suitable point for the site of the plant, but, of course, all the camps in the State will have due consideration. If such a project can be carried through and held free from politics and local prejudices, it should be a great help to the mines of the entire State.

For many years the office of Commissioner of Mines of Colorado has been a political sinecure, and held by men whose efforts were chiefly confined to drawing salary and sitting in the comfortable rooms in the State capitol. The new commissioner, T. Hanahan, who took office last May, however, is making himself felt and heard and has been traveling steadily since his appointment, his itinerary to this date covering nearly every mining camp in the State. To poor men who are doing their best to comply with the law he is considerate, and lenient as to time in which to make necessary improvements for the safety of their workings, and to those who are amply able to do so and will not, his simple orders have been: "Do as I tell you or I will close your mine." The mining interests of the State have long been in dire need of such a policy, and Colorado is to be congratulated on the new régime. The present commissioner is a practical miner and mine manager of 30 years' experience in the State, and this record is of considerable advantage.

Butte

Oct. 11—Suit was brought against the Anaconda Copper Mining Company and the Boston & Montana Company, on Oct. 4, for a ½ interest in the Pennsylvania mine and a like interest in the profits of ore mined therefrom since Feb. 8, 1897, estimated at $25,000,000. The plaintiffs are Alice McKinnon, as guardian for Pearl Hoskin, and Mary H. Jones, as guardian for Mary Hoskin, William Wolverton, Eva Wolverton, Maud Daniels, William Thomas, Alice McKinnon, Mary H. Jones, Agnes Griffith, Thomas Thomas, Griffith Thomas, David D. Thomas, and Ann E. Carver. Their contention is that as heirs of William Watkins Thomas, they have been owners of a ½ interest in the mine since Feb. 8, 1897, through purchase from William Harris, one of the original owners.

The new office building of the Anaconda company is nearly completed and the work of joining the office forces of the various subsidiary companies has commenced. The Butte & Boston clerical office moved in Oct. 1, and the Boston & Montana offices will move the latter part of October. The Butte & Boston engineering office will be combined at the end of October with the Boston & Montana engineering office, all to occupy the same offices as now used by the latter, in the Hennesy building; the Boston & Montana mines department of the Anaconda Copper Mining Company has just been finally dissolved.

Salt Lake City

Oct. 12—In a statement issued to stockholders, Urban H. Broughton, who has resigned as president of the Utah Consolidated company, says that since the annual report of March, 1911, exploration and development have been vigorously carried on, opening known orebodies at depth on No. 10 level, in partial development of No. 11 level and in prospecting virgin territory west of previous workings. A small tonnage has been opened on No. 10 level and the grade of the ore on No. 11 level is below the mine average. The net result is that tonnage equal to the amount extracted has been placed in sight but containing less copper, gold and silver. Exploration in the western territory has resulted in partial development of two lead orebodies. There is now in sight 23,000 tons of direct smelting ore, averaging 17 per cent. lead with good gold and silver contents, and 15,000 tons of concentrating ore averaging 7 per cent. lead. A three-compartment shaft has been sunk from No. 7 to No. 11 level, and equipped with electric hoisting machinery. Net profits of $300,000 are estimated for the year.

Duluth

Oct. 14—The finding of an iron-ore deposit near the central part of the northern boundary of Koochiching county, near the town of Indus, was reported recently by a Chicago man who had been traveling through the Rainy Lake district. He states that there is a test pit down over 25 ft. in a body of hard ore, which was uncovered not far below the surface. If this reported find develops into anything, it will be of interest geologically as well as commercially, for this region is well out of line for an extension of the present known Minnesota ranges. It is quite probable that the country for some distance around is of the same geological formation, and the discovery of commercial ore in a hitherto comparatively unexplored and perhaps discredited district would be of considerable importance. That there is a possibility that iron exists in Minnesota, in places least suspected, is a fact well known to those in touch with the exploration work going on.

Deadwood

Oct. 13—One Troy pound of pure Black Hills gold will be a present given to President Taft by Black Hills mining companies on the occasion of his visit to Deadwood and Lead. A number of mills made contributions to the bar, and the whole was refined at the Wasp No. 2 assay office. A Deadwood jeweler ran the gold into an ingot, and when engraved suitably it will make a unique present.

Free assaying for prospectors is the latest encouragement to be given them by the Deadwood Business Club. Several of the mining companies offered to make the assays; samples of ore are left with the secretary of the club, who receives the returns and issues the certificate upon a blank form with imprint of the club. Under the terms of the offer, no person is allowed to have more than 10 samples per month assayed free. The plan has been in operation nearly a month, a large number of samples have been treated and as a whole the plan seems to have accomplished its purpose. For a number of years prospecting has been neglected in this section, but during the pleasant weather this autumn it will no doubt be stimulated by the free-assaying privilege.

According to L. P. Jenkins, assayer in charge of the U. S. assay office, that institution, during the quarter ended Sept. 30, purchased bullion to the amount of $1,855,000. The entire amount was from Black Hills mines, and reflects a healthy condition of affairs. Insofar as production is concerned the district is in better shape than ever before, but development of new properties is not being undertaken as fast as at some previous times. The present high production, however, should encourage development.

Toronto

Oct. 13—According to the report of the Ontario Bureau of Mines for 1910, the production of the mines shows Ontario to be the third largest producer of silver in the world. Practically all of this silver came from the Cobalt district. The silver development at Cobalt has stimulated silver prospecting in all parts of the province where its presence has been known previously and a resumption of activity is reported from Thunder Bay and other districts. Prof. M. B. Baker's report on the examination of the Mattagami river coal deposits, states that their use will be confined to the region adjacent to the deposits.

A table of fatal accidents in Ontario mines gives a total of 48 for the year, of which 29 were underground, and 19 in surface workings. The table of non-fatal accidents totals 47 below ground and 20 above. Ten of these were due to premature explosions, or drilling into dynamite at the bottoms of old holes.

E. E. Stockton, of the Canadian Auditor-General's department, who has returned from the Yukon where he has been auditing the government accounts including the gold royalties, states that the gold production of the Yukon district this year will be about $4,500,000 or approximately $250,000 in excess of that of 1910. The Yukon Gold Company had seven dredges in operation and was extracting gold by other processes; much work was also done by other companies.

Porcupine

Oct. 13—The first property in the Porcupine district at which electric power from the new Sandy Falls plant is being used, is the McEnaney, where the current was turned on about the first of the month. The Sandy Falls plant is now ready to distribute about 2000 h.p., and it will have an ultimate capacity of about 3000 h.p. Good progress is also being made at the Wallberg plant at Wewaitin falls and large amounts of machinery and supplies are being sent up the river. The low water in the Mattagami river is delaying matters to some extent, as it is also delaying the transporting of supplies into the mining properties of Bristol and Carscallen townships.

The new gold rush into the West Shining Tree district continues and it is stated that 1000 men are in there staking. Mackenzie & Mann, of the Canadian Northern railroad, are believed to have an option on Gosselin properties and a force of men has been sent in to develop them. The formation is a greenstone schist and the veins are similar to those in Porcupine. While the district has considerable merit, it is believed here to be overrated. In any event sufficient work has not yet been done to warrant the claims made for it.

Cobalt

Oct. 13—During the month of September, 19 Cobalt mines shipped a total of 4,775,040 lb. of ore, an increase of 200 tons over the same period of last year.

There is some agitation at present in northern Ontario for the establishment of a new judicial district and center. At the present time the judiciary center with the registry and other offices connected with a court, are situated at North Bay. Between North Bay and Latchford is a stretch of 100 miles of barren and unsettled land, while still further north between Latchford and Englehart, is a thriving section with a population of at least 25,000. The waste of time and money in traveling to North Bay with every case is considerable, and it is felt to be only fair that a new center, for the handling of the northern business, should be established.

Chihuahua

Oct. 9—Mining and industrial conditions have shown marked improvement since Oct. 1, which may be attributed to renewed confidence created by the quiet national elections and to the enthusiastic inauguration of Abram Gonzales as governor of the state of Chihuahua. These events may be regarded as certain indication of the continued pacific condition of northern Mexico and of the country in general. Also, the sending of Gen. Pascual Orozco at the head of military expeditions into the states of Sinaloa and Coahuila for the pacifying of the marauding bands and discontents has had a quieting effect. Even the anti-Maderistas appear to realize that it is time for the cessation of warfare and for return to peaceful vocations if the country is to progress as it should. On the whole the situation is far more satisfactory than the most sanguine had anticipated at this early stage of the Maderista regime and there is no valid reason for believing that this encouraging status may not continue indefinitely. Such, in any event, is the general view of both natives and foreigners.

Important mining events of this month include the official announcement of the early blowing-in of the Chihuahua smeltery of the American Smelting and Refining Company and of the immediate addition of two furnaces, thus making the daily capacity of the plant about 1000 tons; the inauguration of regular train service to the rejuvenated Cusihuiriachic camp over the branch line from San Antonio on the line of the Mexico Northwestern railway; the making ready for the starting of the Terrazas smeltery of the Rio Tinto Copper Company, and the movement started by Parral business men for the building of a first-class wagon road from Rosario on the line of the National Railways of Mexico to the enlivened Guanacevi camp.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

W. A. Beet, mining engineer, Seward, has completed an investigation in the Red mountains, and reports extensive deposits of chrome iron in that territory, seven miles from Seldovia. A bond has been taken on the property for a Pittsburg iron firm.

Another shipment of bullion has been received at the Seattle assay office, consisting of $260,000 from Nome and $25,000 from Iditarod. B. F. Millard, Valdez, has bonded six claims located last month by parties near the Cliff mine. These claims will be developed.

Alaska Treadwell—For the month ended Sept. 15, 79,380 tons of ore were crushed, yielding $205,626 gross and net $113,078. Operating expenses were $92,548; construction, $18,338. The ore averaged $2.66 per ton.

Alaska-Ohio—The company is considering the installation of an hydraulic system. C. C. Griffith, Skagway, is manager.

Pioneer—This company recently paid a dividend of $150,000, making a total of nearly $3,000,000 paid. This is the largest mine operating at Nome.

Mayfield—The property has been taken over by M. M. Reese, of Valdez, who is making plans for the immediate development of it. The property is situated near Shoups bay.

York Dredging—The first run of the plant which is working placer tin deposits at Cape York, near Nome, produced 70 tons of this concentrate.

Nome—The first test of ore in the custom stamp mill, bought by local merchants, averaged $70 per ton. Prospectors are pleased with the result of the test.

Alaska Free Gold—A 20-stamp mill is now *en route* to this property, at Knik, and will be freighted in over the snow this winter, so as to be ready for operation next spring.

Zimmerman & Meyers—These men are considering the installation of a large hydraulic plant for their claims at Knik, in the Willow Creek district.

Arizona

Gila County

Miami—The concentrates are being shipped to the Greene-Cananea smeltery in Sonora, Mexico, with which the Miami company has a five-year smelting contract. The mining method devised by Supt. N. O. Lawton has thus far worked out well. One of the rooms, 225 ft. long by 50 ft. wide, has been worked out nearly to the capping, a vertical distance of about 125 ft. Two more rooms are well advanced and there are two being started. It is the present intention to top-slice the pillars. All ore is being extracted through the 420-ft. level. The crosscut to the orebody is being rapidly advanced on the 570-ft. level. The mill, under the management of F. W. Solomon, formerly in charge of the Nevada Consolidated mill, is running steadily with four sections in operation. The concentrating machinery, consisting entirely of Deister tables, is reported to be working most satisfactorily. It is expected that the fifth section will be running by Nov. 1.

Inspiration—Surveys for pumping stations, reservoirs and pipe lines are still in progress at Wheatfields and Inspiration ranch. The site for the proposed 5000-ton mill has not yet been selected. Alterations of the experimental mill are being made.

Superior & Boston—The McGaw shaft is down 1167 ft. with 4 ft. more to go to reach the 12th level, where a station will be cut. This is the only development work going on at present. William G. Rice, president, is reported to have announced that the proposed consolidation with Arizona Commercial has not matured. The offer has expired, the required amount of bonds not having been deposited.

Live Oak—Five churn drills are being operated, all of them now within a few hundred feet of the western boundary. While no assay records of drill holes are given out at this time, yet it is known that some of the recently drilled holes have disclosed ore. The two-compartment shaft, No. 2, being sunk on a drill hole reported to have disclosed a 200-ft. thickness of ore near the western end of the property, is down over 850 ft., and is still in ore, having penetrated it at a depth of 705 ft. The crosscut from No. 1 shaft has not yet reached the orebody.

Globe Western—The inclined shaft is being deepened and drifting is being done on three levels. Joseph C. Erman, of Globe, is manager.

Southwestern Miami—Hole No. 1 is about 1020 ft. deep, at which point it caved badly. The hole is now being reamed to larger size and the management expects to attain considerably greater depth. The hole is now bottomed in iron-stained, silicified schist containing a little copper carbonate and silicate. Hole 79 of the Live Oak company, about 160 ft. from the common boundary, is reported to have disclosed good ore. While nothing has been proved, the above conditions are thought to indicate the probable extension of the Live Oak orebody into Southwestern Miami ground. Fred W. Hoar, of Globe, is manager.

Summit—The company is mining on the Pasquale vein and is employing about 20 men. Development work has been discontinued and mining is confined to one stope on the fourth level. The back of this stope is about 30 ft. above the level, is 60 ft. long and shows a streak of chalcopyrite ore from 6 in. to 2 ft. wide, averaging about 25 per cent. copper. The ore is sorted in the stope to about 20 per cent. grade. The shipments to El Paso have been averaging 200 tons per month of 20 per cent. ore and the mine is more than paying operating expenses at the present time.

Santa Cruz County

Alto—This company is shipping ore from two veins; lead-silver ore comes from one vein and a gray copper ore from the other.

Glove—The Sheehy brothers are shipping lead carbonate ore from this mine. At 45 ft. in the shaft the orebody was 12 ft. wide.

Bland—T. M. Heck, working on this property, in the lower tunnel, has struck ore 12 ft. wide, which promises to give a good tonnage. This is a sulphide copper ore carrying some silver and gold.

California

Amador County

South Amador—The unwatering of the shaft to the sump at 1200 ft. has been abandoned for the present, and attention turned to the development of the vein in the drift from the 500-ft. level.

Oneida—The shaft is unwatered to the 1500-ft. level. The large pump taken out of the 1580-ft. level will be replaced after the level is cleared of water.

Mitchell—Stock in this mine is being sold to provide funds to install a stamp mill and cyanide plant. Edwin A. O'Donnell, of Pinegrove, is superintendent.

Calaveras County

Melones—Operation was suspended at the end of September for the purpose

of making necessary repairs and overhauling the machinery. A new water ditch, 1600 ft. long, will be constructed for power purposes.

ELDORADO COUNTY

John A. Sowell—This company has purchased 120 acres of gravel claims, near Georgetown.

Douglas—Suit has been instituted at Sacramento against this company by Susie G. Gordon for $25,000, alleged to be due as commission for the sale of 500,000 shares of stock.

KERN COUNTY

Four Ace—This company, composed of C. G. Illingworth, William Atkinson and A. Nixon, has taken a lease on the Santa Ana mine and the Napoleon and Yucca Tree, adjoining claims in the Stringer district. A 2-in. air line, 200 ft. long, is being laid to connect with the compressor at the La Crosse mine. A new hoist and machine drills will be installed.

Good Chance—The company, composed of C. G. Illingworth, C. Dunnell and B. Osdick, will install a dry crusher and hoist. The ore will be cyanided at the Tip Top mill for the present.

NEVADA COUNTY

Fairview—An investigation of the affairs of this mine at Relief is in progress. A stamp mill costing $25,000 was installed, but was operated only a short time. Most of the stockholders are residents of Calumet, Mich., and were promised large returns.

Brandy City—Supplies for the winter operation of this drift gravel mine are being hauled in; a new machine shop is being built and other surface improvements made. Forty men will be employed during the winter.

PLUMAS COUNTY

Hose—This mine near Meadow Valley has been purchased by J. F. Becker, of Oakland. The mine is equipped with a 5-stamp mill.

Antlered Crest—The installation of air drills is contemplated. Work on the long tunnel has been temporarily suspended.

SAN BERNARDINO COUNTY

Williams Kaolin—Plans for marketing the product of this clay deposit near Riggs in the Silver Lake district are being made by H. D. Love & Co., of Los Angeles. A high-power auto truck is to be installed for transportation of the kaolin to the railroad.

TEHAMA COUNTY

Northern California—The barge for the installation of a suction dredge at Jelly's Ferry on the Sacramento near Red Bluff, 60 ft. long and 25 ft. deep, has been completed and the 12-in. pump, capacity 340 gal. per hr., is on the ground. Electric power will be employed. F. H. Mack is general manager.

TRINITY COUNTY

Union Hill—These placer mines near Douglas City, recently optioned to W. A. Boland, have been sold by him to D. W. Shanks, of Los Angeles, and New York associates.

Trinity Exploration—This company has been formed, with Henry W. Miller, New York, president; D. W. Shanks, Los Angeles, vice-president. David Goodale is manager. Property including 700 acres of dredging ground on the Trinity river between Carrville and Trinity Center has been acquired and is under the charge of R. C. Specht. Three Keystone drills are in operation. If the developments warrant, a large dredge will be installed next summer.

Colorado

CRIPPLE CREEK DISTRICT

Big Bull hill, opposite Bull hill proper, where so many of the richest mines are, has never yet produced a pay mine. It is now opened by a tunnel 3000 ft. in length, the contract for which has been let by a Kansas City company, owners, to Joseph Plumas.

Camilla—A four-years lease has been let to A. T. Rosen, of St. Paul. The shaft is to be sunk an additional 500 ft. in the first year and the royalty is 20 per cent.

South Burns—There were 30 applications for subleases on this property, from the South Burns leasing company. Ten were granted.

Empire State—This property of the Isabella company, Lester Grant, superintendent, will be leased in blocks. Eight leases have already been granted.

Ajax—The Clancy process will soon be in full operation, it is said. Crushing has commenced and the 500-ton tanks will be filled at once. A. M. Warwick is manager.

Gold Sovereign—A strike of 4 ft. of sylvanite ore is reported in the fifth level, by the Union Leasing Company.

School Section—The September output of this mine at the base of Bull hill, was 28 cars of mill ore.

LAKE COUNTY—LEADVILLE

Nevada—It is reported that a body of lead carbonate ore, 6 ft. in width, has been opened in this mine on Bruce hill, by T. Simpson, lessee. The ore has been followed for 30 ft. and a small shipment made.

St. Louis—Forty tons of ore were shipped last week by Norman Giles, sublessee.

Lillian—Recently 100 tons of good-grade carbonate of zinc ore were shipped.

SAN JUAN DISTRICT

Gold King—Otto Mears and J. H. Slattery have leased this mine and will operate it by a system of subleasing. John Mattivi, one of the subleasers, is reported to be getting out free-gold ore, in which the gold is present as flakes of rice size. The leasers expect to start the mill within a few days, running on the pyrite ore which constitutes the greatest part of the orebody.

Tomboy—During September the mill crushed 9300 tons of ore which yielded $84,000 gross and net $42,500. Expenses were $41,500 and $736 were expended on permanent improvements.

Calliope—The mine below Ouray has started operations again with 10 men, and the Dexter drift is to be driven with machine drills to its intersection with the Calliope dike. This is one of the early producers.

Frank Hough—This property, owned by A. E. Reynolds, of Denver, is to be developed by a tunnel 3500 ft. long, driven from the south side of Engineer mountain, in the Poughkeepsie district, making the ores tributary to Ouray.

Bagley Tunnel—The tunnel at Animas Forks is now in 6000 ft. and has cut a great many veins of low-grade ore. Charles Gagner, manager, has finished a 1200-ft. raise to the Red Cloud mine. A. W. Eisenbeis, representing the Eastern stockholders, has just made an inspection of the property, and a mill is in contemplation. With proper metallurgical methods this property will be a large producer.

Cumberland—This vein in the Ouray district, intersected by the Revenue tunnel, shows 540 ft. of a drift, all in silver-lead ore from 3 to 5 ft. wide, which will pay to treat at the Revenue mill.

San Bernardo—This early-day producer in the Telluride district, long dormant, is being opened again; a modern milling plant is to be installed and a tramway built from No. 4 level to the railroad.

Casey—In Burns gulch, James Kelly is taking out ore from this group and is expecting to make a shipment within a few days. The ore is said to be composed of ruby silver and free gold in lime-spar gangue.

SILVERTON DISTRICT

The Big Horn tunnel, which was driven 500 ft. in 1907, is to be driven 2000 ft. and under the Congress, St. Paul and other Red Mountain mines, giving them an outlet on the Silverton side and intersecting the vein at a depth of from 500 to 675 ft. A company has been incorporated for this purpose, called the Red Mountain Tunnel and Transportation Company, the chief movers in this enterprise being Levett Brothers, of New York.

SUMMIT COUNTY

D. B. Hill—This mine, on Mt. Lincoln, a good producer 25 years ago, is being opened under the management of J. W. Jackson, of Denver. C. G. Rogers is superintendent.

Idaho

Coeur d'Alene District

C. & R.—This property, situated on Cedar creek, has just installed a four-drill compressor and work will be resumed at the mine. Lower drifts will be driven to open up the vein at a depth of 300 ft. The surface showing and the ore encountered in the upper workings warrant considerable prospecting.

Idora Hill—A force of 23 men is now working at this property, which is situated in the Sunset Peak section. The development work being done is rapidly blocking out a large orebody. A quantity of first-class ore is ready to be shipped and will be taken out this winter over the snow road. The milling-ore dump will soon require the construction of a mill. This operation will encourage work in other properties.

Hercules—The arrangements have been completed between this company and the Hummingbird, whereby the former is to use and extend the latter's ½ mile of tunnel to cut the Hercules orebody at a greater depth. This tunnel will be known as the Hercules No. 5, and when completed will be over two miles long. An additional vertical depth of 785 ft. will be obtained. The tunnel will make possible the delivery of ore at the railroad, thus eliminating the ½ mile of aërial tramway. The necessary buildings are now under construction and work on the tunnel itself will be commenced before winter sets in.

Kansas

Eastern—Gates & Gray and the Kramer Mining Company have made good strikes of ore on this land at Lawton.

South Side—The mine at Galena has been drained through the 150 level.

Michigan

Copper

Victoria—It is reported that the 19th level east has cut into the copper-bearing part of the lode, and that the ore coming from there is good stamp grade. The lower levels to the east generally are showing up well.

Mohawk—An excellent grade of copper rock is being developed in territory contiguous to Nos. 4 and 5 shafts. The ground in the deeper No. 1 shaft is said to contain some of the best stopes in the mine. Shafts 2 and 3 are below average. The new shaft, No. 6, is about 600 ft. deep.

Calumet & Hecla—It was reported recently in these columns that steam rock drills were being tried out underground. This is not the case; the use of such drills is impracticable in this mine.

South Lake—While exploratory work is said to have resulted satisfactorily, the company is reported to be in need of new financing.

Ojibway—The north laterals are reported to be in good copper ground in a rather flat formation.

Oneco—Attention is still centered on shaft work on the Oneco lode. This shaft is reported 850 ft. deep and is sinking for the 1200-ft. level, from which depth a drill core was taken.

Wolverine—Exploratory work continues at two points. The shaft on the Osceola lode is about 300 ft. deep. The work in the eastern portion of the tract consists of a crosscut driving eastward on the 28th level to intersect a series of lodes disclosed on the Old Colony land.

Adventure—Preparations are being made to crosscut to Nos. 2 and 3 lodes at a depth of 1525 ft. in No. 5 shaft. About 450 ft. of crosscutting will be necessary to reach No. 2 lode and 800 ft. for No. 3. These formations were disclosed by drilling.

New Baltic—It is now believed that there is little doubt that the company has found the northerly extension of the Baltic lode. Work has been hampered by lack of facilities, due to the isolation of the property.

Iron

During the last 10 days the following mines are reported to have been closed on the Marquette range: Imperial at Michigamme, Barnes at North Lake, Northwestern and Princeton No. 1 at Gwyn. The latter two are Cleveland Cliffs properties.

The tax commission of the State, after a public hearing, announced that the valuation of the iron properties in Marquette, Gogebic, Iron and Dickinson counties had been fixed at $85,637,500, as compared with the present total of $19,626,008, and the report of J. R. Finlay which recommended $119,150,000.

Zimmerman—Extensive improvements are being made by the Spring Valley Mining Company, operators of this mine in the Iron River district. A shaft is sinking and structures being erected include an engine and boiler house and a shaft house. The latter will have a steel headframe, 105 ft. high.

Minnesota

Mesabi Range

Swallow & Hopkins—This property at Kinney has permanently suspended operations for this season.

Webb—This Shenango Furnace mine at Hibbing will be one of the largest underground producers on the Mesabi range next season. The old No. 1 shaft has been dismantled and will be used as a large raise for the various levels. The large and uptodate power plant, containing a battery of four Erie boilers is in commission. It is of brick and steel construction with a large brick smoke stack. The new machinery installed and in use consists of a Sullivan hoist, Rand compressor of about five drill capacity and a new direct-current generator. Electric haulage will be used underground. The Great Northern railroad has recently finished the grading on the spur into the new No. 2 shaft. This shaft is down to the bottom of the orebody, and has a steel headframe, a product of the American Bridge Company. Development work is being pushed rapidly and at present about 10 cars per day are being shipped.

Drake & Stratton—This contracting company, by Nov. 15, will finish up all of its work on old contracts for the Oliver Iron Mining Company.

Poole—Winston Bros., contractors, will have finished the work on this mine for the Oliver Iron Mining Company by Nov. 1.

Leetonia—This Jones & Laughlin mine is sinking a four-compartment, vertical shaft, 10x12 ft. This is the only mine on the Mesabi range with an entry similar to those used in coal mines. The orebody dips at about 6 deg., and the double-compartment entry, 16x8 ft., has been driven over 1300 ft. on the footwall at a pitch of 6 deg. The new vertical shaft will be used in connection with this inclined entry.

Oliver—The company will conduct extensive drilling operations near the villages of Mesabi and Aurora in sections 2, 19, 21 and 30. This is practically virgin territory as regards exploration.

Schley—An accident recently resulted in the death of a miner. The man was struck by an ore car.

Missouri

Barney Parker has sold 140 acres of land at Nights Station to O. F. Prince and W. L. Duncan, of Carthage, for $14,000 and the ground will be prospected.

Kitty Mack—This mill has been removed from the West Joplin sheet-ground district; a part has been moved to the Big Six mine at Duenweg, and the balance to the Morning Star mine at Nelville, Arkansas.

Mosely—This mine which was first opened in 1847 has been reopened. The company is preparing to take up a stope over the entire mine.

Ramade—The Maple Leaf mill, 300 tons capacity, has been bought by this company and will be removed to the mine at Carterville.

S. B. & D.—The mill at the Tri City mine at Carthage has been completed and will soon be producing.

Grand Haven—This company has bought the Heap-O'Brien mill at Quapaw and is removing it to the old Grace Ping mine at Joplin.

Good Enough—E. B. Rhodes & Co., have bought the Underoof mill at Webb City and will move it to the mine in the Chitwood camp.

Montana

Butte District

Anaconda—The cylinder head of the hoisting engine at the Badger State mine blew out Oct. 5, necessitating a shutdown of several days until a new head could be cast. No one was injured by the accident, and the men working in the mine were able to get to the surface by way of the North Butte company's Speculator mine.

Combination—On a judgment by default, secured by John P. Reins against the Reins Copper Company, the Combination, Ella and Louise claims of the company, situated in Meaderville, east of the Leonard mine of the Anaconda company, together with the mining machinery and fixtures, were sold at a sheriff's sale on Oct. 6 to Mr. Reins, former president of the company, for $25,083.45, the amount of his judgment. During former operations the shaft was sunk 1200 ft. and 4000 ft. of crosscuts and drifts were run. Some ore was struck, but the mine was abandoned, owing to an excessive amount of water. Since then the Ella workings have been completely drained through the Leonard.

Deer Lodge County

Hidden Lake—The lease held by Harry C. Bacorn expired Oct. 1. The eight owners of the property have begun an extensive campaign of development. The work done by Mr. Bacorn was almost entirely confined to the Gold Bug No. 2 claim, but D. T. Robinson, president of the company and in charge of operations, will sink and crosscut on the Gold Bug and also open up several veins exposed on adjoining claims, of which there are 18 in all. It is planned to operate on a larger scale than formerly and a cyanide mill will be erected with an initial capacity of 100 tons.

Jefferson County

Boston & Corbin—Since the first report of consulting engineer J. W. Neill, the mine has been opened to the 1200-ft. level; the vein has continued with depth and improved in quality, width and regularity. If test runs, to be made by the General Engineering Company, of Salt Lake, are satisfactory, a mill will be erected.

Alta—M. L. Hewitt is in the East at present interviewing men who were interested in this property during the time of its former operation, with a view of financing a company to reopen and develop the mine at an early date. Leasers are working the upper levels at present and making occasional shipments. The mine lies near the Boston & Corbin properties.

Madison County

Gold Coin—The new mill about to be installed at the mine has been shipped from Chicago and the management expects to have it ready to start by the middle of December. E. M. Hand, manger, has just taken a lease on the Ajax property from Miller & Hansen and it is thought the property will be merged with the Gold Coin.

Nevada

Comstock Lode

Ophir—A south drift in the Hardy vein on the 2200-ft. level has been started opposite the north drift, and is in low-grade ore. The ore recovery last week from the stope on the vein amounted to $24,000. The prospecting drift on the 2400-ft. level has turned more to the west and is making for a point under the present Hardy vein workings on the levels above; the vein at the present header contains porphyry and quartz assaying low. The company has a large cash balance.

Mexican—The framework for the new mill is practically completed and the roof will be on next week. The machinery for the big plant has already begun to arrive, and the tube mill, mortars and rock crushers are being put in place. It is believed that the mill will be ready for operation as soon as the electrical equipment arrives from the East. The stoping of first-class ore from the 2500-ft. level continues with shipments of three railroad cars per week to the smeltery.

Union Consolidated—An old east crosscut has been opened on the 2500-ft. level, leading to a joint winze with the Mexican used in the early days. The winze is full of water but soundings taken show it open in both compartments down to the 2700-ft. level. With the installation of new pumps this winze will be used in the exploration of the 2600 and 2700 levels.

Crown Point—A run of 2000 tons of ore extracted in September has been completed at the Yellow Jacket mill, and will net a good profit over and above expenses. The vein has been found to be 30 ft. wide in places, at the sill floor on the 1400 level, and it is believed to extend downward. The Yellow Jacket mill is now running on ore from the Jacket mine dump.

Elko County

Bluster—A bond on 65 per cent. of the capital stock of this company at Jarbidge is said to have been taken by Patrick Clark. The company will continue development until Mr. Clark takes control.

Esmeralda County

Goldfield Deep—Machinery is reported to have been ordered for sinking the 2000-ft., four-compartment shaft planned by the directors. Actual work is expected to start soon.

Nye County

Tonopah-Belmont—The statement issued on Oct. 2, with checks for dividend No. 9, shows that for the three months ended Aug. 31, 1911, the company received from sales of ore and bullion, $828,668; miscellaneous receipts, $7122. Expenses of mining, milling and administration were $381,413, the net earnings for the quarter being $447,254. The available cash resources at that date were $1,246,773. The company has now developed the Belmont vein from the 900 level to 60 ft. below the 1286-ft. level, where it shows great strength and high-grade ore.

Tonopah Extension—The report for September states that 4415 tons of ore were treated in the 30-stamp mill, the ore averaging $14.95 per ton and the extraction being 91½ per cent. The gross returns were approximately $60,000, the net profits approximating $30,000.

West End—A shoot of high-grade ore, 8 ft. wide and averaging about $40 per ton, has been opened up in a raise from the 500-ft. level. The company's new mill of 20 stamps is treating 80 tons per day for an indicated extraction of 94 per cent., the ore averaging about $14 per ton.

New Jersey

Shoemaker—These iron mines, near Belvidere, operated under lease by the Hendson Iron Company, are reported to have shut down for the present. The pumps have stopped and the mines will be permitted to fill. The ore is said to be of good quality, but pockety.

New Mexico

A syndicate of Birmingham, Ala., men is said to be interested in the development of the iron and coalfields in the White Oaks district and to be considering the construction of a railroad from Carrizozo to White Oaks.

Rosena—This company which recently acquired the Timmer silver mines, near Whitewater, Grant county, is reported to be making regular shipments of good ore to the El Paso smeltery.

Chloride Flat—The company is reported to be developing the two Bohemian claims near Silver City and to be shipping regularly to El Paso.

Ernestine—The new power house is nearly completed.

Little Charlie—A shipment of 10 tons of ore was recently made to El Paso from this mine in the Mogollon district.

Oklahoma

Turkey Fat—A shaft is down 134 ft. on this land at Miami and will continue sinking to the 200-ft. level.

Chapman & Lennan—This company has made another drill strike on its lease on the Emma Gordon land at Miami and has ore down to the 300-ft. level.

Oregon

Last Chance—This property in Baker county, is being operated by the Blue Mountain Mining Company, under Oliver Connor, manager, Sumpter. A small reduction plant is to be installed.

Dowdle—The Oro Del Norte Company has acquired this property near Crescent, Klamath county, and will install new machinery. S. S. Reed has charge.

Glade Consolidated—This company is developing a placer mine near Granite, Baker county. A large ditch is being built, and considerable other work is being done.

South Dakota

Black Hills District

Homestake—Tests of the wireless installation between the office at Lead and the hydroelectric station on Spearfish creek, are not completely satisfactory, and a stronger set is to be used. It is believed that high points of ground between the two stations interfere with the waves.

Black Hills Smelting—At a special stockholder's meeting recently held, the capital stock was increased from $100,000 to $200,000. It was found that the first figure did not cover the cost of the smeltery and equipment, which is being erected at Galena.

Utah

Juab County

Tintic shipments for the week ended Oct. 6 amounted to 153 cars.

Centennial-Eureka—Shipments of 8000 tons per month are being made.

Iron Blossom—The management expects that the drift on the 600-ft. level of the No. 3 shaft will soon reach the point where the silver-lead orebody of the 500-ft. level cave is looked for. In the last week in September 36 cars of ore were shipped.

Sioux Consolidated—Shipments are being made, but much development in search of new resources remains to be done. The mine is reported to be in good condition.

Opohongo—Foundations for a new ore house have been laid. The north drift on the 600-ft. level is in good grade ore, as well as the winze sunk 50 ft. below this level. Two cars per week are being produced, the output coming from the 400- and 600-ft. levels.

Opex—Expenditures for the last three years have been $254,449; with the payment of the last assessment there will be about $1500 in the treasury. It is reported that operations, recently suspended, are to be resumed.

Clift—A car of ore was shipped recently from a lease, and another will be ready in 10 days.

Eureka Hill—Operations on company account have been suspended, and it is reported that arrangements for leasing are being made. The company has operated for 41 years, during which time between $13,000,000 and $14,000,000 were produced. It is a close corporation.

Lower Mammoth—The entire attention of the management is being devoted to prospecting mineralized ground to the north and west of the shaft on the 1000-ft. level.

Grand Central—An official of the company states that the new orebody is wider on the 2200-ft. level than it is above; it is 40 ft. wide on the 2100 and 30 ft. on the 2000.

Yankee—Five teams are hauling ore from the dump, and shipments will amount to about 15 cars per week. There are about 15,000 tons of this ore, which brings from $9 to $15 per ton.

Gold Chain—The construction of the trestle connecting the new ore house with the dump has been impeded by bad weather, and ore shipments, suspended since Aug. 18 while improvements undertaken jointly with the Opohongo were being made, will not be resumed for 10 days. Up to Aug. 18, the output averaged six cars per week.

Gemini—A dividend of $30,000, the first since 1907, has been declared, bringing the total of dividends paid to more than $2,000,000. The company is a close corporation, with 5000 shares authorized. Four years ago it was necessary on account of water to abandon work on sulphide ore on the 2000-ft. level, and operations were transferred to some of the upper levels, up to that time relatively undeveloped, from which steady shipments have been made. The installation of modern pumping equipment is being considered, which will make it possible to resume mining at depth in the sulphide zone.

Chief Consolidated—The management reports underground conditions to be promising. Two lots of 860 tons of ore brought $10,807; three cars are on the way to the market, one of which is high-grade, and several more will be shipped in the near future.

Piute County

Machinery and supplies are being hauled by heavy freighting outfits from the railroad at Marysvale to the placer gold district near Pahreah, Kane county. Ten miles south of Marysvale some gold properties, carrying free gold, are being opened in a new section.

Bully Boy & Webster—It is reported that the construction of a 100-ton mill will soon be started at this property in Bullion cañon. A part of the material and machinery used will be obtained from an old mill four miles below, but new equipment also will be added. About 100 ft. of a new raise has been driven, opening an 8-ft. vein. Jacob W. Young is in charge.

Shamrock—Ore is being mined and a shipment is nearly ready. Operations are in charge of Dalton & Wolstenholme.

Uintah County

Uintah Gilsonite—This company has for some time been shipping at the rate of a car per week. A shaft has been sunk on a vein 2 in. thick. The gilsonite is freighted to Price. Twelve men are employed, and the number will be increased. It is the intention to mine about 300 tons per month.

Utah County

American Fork—A number of deeds were filed recently with the county recorder, conveying certain mining claims to this company. The claims include the Shealy, Silver King No. 3, Snow Storm, East Star, Silver King No. 2, and others.

Belerophan—This company's property is near the head of Mary Ellen gulch west of the Mineral Flat. Some ore has been found, and is being shipped at irregular intervals. The ore comes from fissures near the surface, and in some places is 3 ft. thick. A tunnel is in 400 ft., and is being pushed to cut the vein at depth, when drifting will be started. Eight men are employed.

Globe Consolidated—This company's tunnel from Mary Ellen gulch near the old Yankee is between 300 and 400 ft. in limestone. Two shifts are being worked. John Cleghorn is president and manager.

Bonneville—Work on this company's tunnel half way between Provo and Springville is progressing at the rate of about 9 ft. per day. The face is in 780 ft., or about half of the projected distance. The tunnel starts in the foothills, and will be driven about 1½ miles to tap a limestone and quartzite contact on the south side of Bullock's cañon. The country rock in the neighborhood shows some mineralization. Water has been encountered, and one of the objects of the tunnel, in case mineral is not found, will be to provide water for irrigating land along the foothills. Twenty-five men are employed.

Eldorado—The tunnel, which is in 200 ft., is reported to have cut a 2-ft. mineralized streak carrying some silver and gold.

Lost Josephine—A contract has been let for driving a tunnel to open ground under the old shaft. Some black gold-bearing sand is reported on the property, which is on Currant creek 35 miles from Heber. There is evidence of early washings supposedly carried on by Mexicans.

Washington

Guarantee—This property at Addy, Stevens county, has been closed down in order to install additional machinery. Operations will be resumed.

Chimacum—The tunnel on this property at Orient, Ferry county, is being lowered, and other development work will be done. A. E. Wilson has charge.

Keller & Indiana Smeltery—H. J. Lefevre, of Spokane, has acquired this property and will repair it soon.

San Poil—Operations have been resumed at this mine, under the direction of J. W. Lloyd, superintendent, Republic. The ore is averaging about $35 per ton.

Canada

British Columbia

Quesnelle Hydraulic—This company which commenced hydraulicking operations on Aug. 18 on Twenty-mile creek, Quesnel mining division, Cariboo, is finding its water supply ample, notwithstanding that no rain has fallen in the district for about two months. The water system, designed and constructed by Howard W. DuBois, is proving fully up to the engineer's promise of capacity and effectiveness. Practically no interruptions to operations have been experienced thus far, only two short stoppages of two or three hours each having been occasioned by unimportant breaks in the new ditch. Smith-LeGrange monitors are being used; under a 300-ft. effective head No. 6 monitors here throw water about 400 ft., while the stream from smaller ones reaches to 600 ft. A pooling reservoir admits of the flow of water being increased to 5000 in. when necessary to use No. 8 monitors to clear away any accumulation of boulders in the sluices. The plant is working satisfactorily and it is expected that when a cleanup is made in November a good recovery of gold will result. Howard W. DuBois is now managing director, Andrew B. Nisbet, superintendent at Hydraulic, headquarters of the company's works, and W. W. Edwards is resident chief engineer.

Ontario—Cobalt

The shipments from Cobalt for the week ended Oct. 6, were: La Rose, 214,520 lb.; Cobalt Lake, 190,990; Coniagas, 139,820; McKinley Darragh, 124,650; Trethewey, 64,800; Kerr lake, 64,100; Temiskaming, 64,020; Nipissing, 63,000; Drummond, 60,000; Buffalo, 58,770; Crown Reserve, 48,300; Colonial, 48,000; total, 1,140,970 lb. Bullion shipments were: Nipissing, 38,319 oz.; Nova Scotia, 24,100; Crown Reserve, 19,230; O'Brien, 11,062; Hudson Bay, 1664; total, 94,375 ounces.

Trethewey—A new vein has been discovered in the southern workings on this property, on the second level.

Olmstead—The discovery of a 4-in. vein of calcite, niccolite and cobalt is reported on this Gowganda property, situated a short distance east of the Millerette and Miller Lake-O'Brien mines.

Ontario—Porcupine

Rea—A statement has been issued to the effect that there is $280,000 worth of ore blocked out above the 200-ft. level. The shaft has nearly reached the 300-ft. level, where a station will be cut. The shaft will be continued to 400 feet.

McIntyre—The president has announced that construction on the 40-stamp mill will be started immediately.

Dobie—Good ore has been struck at a depth of 55 ft. in the shaft.

Gold Pyramid—This Munroe township property is now shipping bullion from its small mill.

Dixon—Some rich ore was recently blown out of the new shaft just started near the McIntyre boundary.

Success—Before discontinuing work on this property, a 4-ft. vein, 130 ft. in length, showing free gold, was opened. The owners are Englishmen, and the future disposition of the mine is under consideration.

North Dome—Power from the Mattagami river has just reached this property and is being used for drilling operations.

Dome Extension—Work has been resumed in the main shaft, power being supplied by the new compressor plant. Diamond drilling is being done, to prove at depth the recent discovery. The company will sink another shaft.

Apex—A six-drill compressor plant has been installed.

Homestead Mines, Ltd.—This Swastika company has been organized with $2,000,000 capital to develop a property of 78 acres, on which free gold discoveries have been made on several veins. Frank L. Culver is president. A tunnel has been driven into the hill for 75 ft., and a shaft will connect it with the surface. The company will lease air power from the Swastika mine for the operation of two drills.

Hughes—It is stated that this property has been sold to Montreal men.

Porcupine Central—The affairs of this company are to be aired in the courts, an action having been entered by a broker named H. B. Willis, on account of the alleged corner in this stock.

Mexico

Baja California

Boleo—It is reported that the harbor improvements at Santa Rosalia and at La Paz were destroyed by a tidal wave.

Chihuahua

Arizona-Parral Mining Company—This company has been unwatering the Tajo mine and expects to be able to start operation of the mine and mill some time this month. H. H. Utley is manager.

Esmeralda Mining Company—Hoists and pumps are to be installed at the mines of this company, near Parral.

La Cruz—At this Ocampo mine a large shoot of high-grade silver ore has been found. A. D. Robinson is manager.

Markilda—From this mine, near Coyame a carload of zinc ore was recently shipped to the Chihuahua Ore Testing and Sampling Company. H. Faivre is manager.

Cia. Minera Julieta y Anexas de Almoloya—This property was purchased last December by an English syndicate, but was returned to the original owners in default of payments. Three dividends of 10 per cent. each have been declared to be paid in October, November and December. Paul Ginther is in charge.

Iberia—Plans are being formulated for the reopening of this mine, which has not been operated for a long time.

Compañia de Naica—This company recently installed a 250-h.p. engine at its mine at Naica, which will afford facilities for increasing the production to 300 tons per day. Joseph Meyer is in charge.

Estella—A new pipe line will be built from this Santa Eulalia mine to the Potosi mine of the Chihuahua Mining Company. S. G. Burn is in charge.

Abundancia—At this mine, owned by a French syndicate, a shoot of high-grade ore has been found.

Bien Venida—This Santa Barbara mine is under option to Andreas Peiffer, of Chihuahua. The price demanded by the owner, Lorenico Morales, is said to be $300,000.

Mexican Consolidated—Carlos Iwonsky and Ernesto Grohman are working over the dumps at San Pedro in the Guanacevi district, and by the use of canvas tables are making a fair recovery.

Casas Mill—This mill in the Guanacevi district has been leased to Ernest Steib, who also operates the Rosario mine and mill. A portion of the San Pedro dump will be treated in the Casas mill.

Terrenates—This Villa Escobedo mine is being operated by Juan Almanzan, who is mining ore of good grade at low cost from the surface by quarrying. The ore is being sent to a local mill.

Mexico

El Oro—During September the mill crushed 30,510 tons of ore yielding $203,010 gross and net $77,800. Operating expenses were $97,950 and $27,260 were expended in development.

Sonora

San Lorenzo Mining and Smelting Company—The smeltery of this company will be ready to be blown in about the last of November. Wayne Canfield is general manager.

Greene-Cananea—High-grade ore has been found in the Puertocitos mine, but the extent of the shoot has not been determined. Mining was resumed at this property about two months ago. The mine was closed in the first half of 1910 to curtail production.

Piedras Verdes—This mine, 10 miles from Alamos, and a producer of low-grade copper ore is under option to Boston men.

South America

Dutch Guiana

A correspondent reports that a discovery of cinnabar has been made on the Maroni river, and it is believed to be the first discovery of this ore in this country.

The Markets

Coal Trade Review

New York, Oct. 18—Not much difference is apparent in the coal trade in the West. Domestic coal is the mainstay of the trade just now, but some increase is apparent in the demand for steam coal, which is encouraging. The tonnage reports from Lake Superior indicate that the Lake trade has been large this year.

The seaboard bituminous trade shows some improvement, though it is not specially active. Both tidewater and all-rail shipments from the mines are improving. Coastwise trade is increasing in activity, as is usual at this season.

Anthracite trade is large and steady; the heavy production in August and September did not seem to exceed the demand, and no large quantity went to the storage yards.

In Washington, Oct. 13, the Commerce Court denied the application of the Lehigh Valley Railroad for a temporary injunction against the order of the Interstate Commerce Commission in the Meeker coal case. It is not understood that this finally disposes of the case, as the argument was made merely upon a temporary injunction, and the merits of the case are yet to be heard. The order of the commission, which is to go into effect Nov. 15, directed the railroad to pay over $200,000 in reparation to independent shippers of coal from the Lehigh district to tidewater at Perth Amboy, and ordered a reduction in the rates on the coal shipped by independent anthracite operators.

Coal shipments through the Sault Ste. Marie canals, season to Oct. 1, short tons:

	1910	1911	Changes
Anthracite.....	1,209,269	1,485,087	I. 275,818
Bituminous.....	8,896,296	10,079,890	I.1,183,594
Total.....	10,105,565	11,564,977	I.1,459,412

The total increase this year was 14.4 per cent. This seems to negative previous reports that the Lake coal trade had been slow this season.

IRON·TRADE·REVIEW

New York, Oct. 18—The iron and steel markets continue to show a large volume of business at the current low prices; but this trade is still mainly in orders for early delivery. Buyers hesitate to make commitments far ahead, and in many cases also sellers are not pressing future sales, probably hoping that prices will improve. Evidently low prices are helping business, and new construction is more active.

Finished material continues to show an active market for structural steel, sheets and plates, as well as for the smaller lines like bars and wire. An unusual amount of shipbuilding is forward in seaboard territory, which will take considerable lots of plates and shapes. Railroad orders for cars and bridges are coming out in increased volume, though there is little doing in rails.

Pig iron has been rather slow and only moderate orders have been placed during the week. These are chiefly for foundry and basic iron. Pipe foundries have taken some round lots, of which Southern iron has formed a good part. No advances in price are to be noted.

Tinplate has been reduced, the American Sheet and Tin Plate Company having cut the base price 20c., from $3.60 to $3.40 per box of 100 lb. The business has been large this year, and it is a notable fact that the exports of tinplates this year have largely exceeded the imports, for the first time. The makers have succeeded in securing the bulk of the canning business, including that for export, in which imported tinplate has been heretofore used, as the makers secured a drawback on exported cans.

A despatch from Birmingham, England—the authority for which is not given—says: "It is learned that the International Committee of Steelmakers, appointed at the Brussels conference in July, has held a meeting, at which the various proposals made by Judge E. H. Gary, chairman of the United States Steel Corporation, were considered, but that these propositions were not accepted. Considerable dissension is said to have developed in the discussion of these plans."

Tinplate Production—The American Iron and Steel Association reports that the production of tinplates and terne plates in 1910 amounted to 1,619,005,000 lb., or 722,770 gross tons, an increase over 1909 of 248,217,000 lb., or 110,311 tons. Of the total in 1910 1,450,821,000 lb., or 647,688 tons, were tinplates, and 168,184,000 lb., or 75,082 tons, were terne plates. All the tinplates produced in 1910 were made of steel, but of the 168,184,000 lb. of terne plates about 5,765,000 lb. were made of iron and about 162,419,000 lb. of steel. Small quantities of pure lead-coated and aluminum-coated steel sheets were made in 1909 and 1910.

Steel Trade Notes—Suit has been begun for the appointment of a receiver for the Western Steel Corporation of Seattle, Wash. Proceedings have been delayed, pending an effort to adjust the company's affairs.

The plans for the reorganization of the Southern Iron and Steel Company, and its consolidation with the Alabama Consolidated Coal and Iron Company, have been completed. The new company will acquire the two properties, subject to about $2,000,000 underlying bonds of each. For this purpose and for raising $4,130,000 cash capital, it will issue $5,000,000 6 per cent. bonds, $12,500,000 6 per cent. cumulative preferred stock and $12,500,000 common stock, or $30,000,000 in all.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Baltimore

Oct. 16—Exports for the week included 334,300 lb. tin scrap to Rotterdam; 12,112,354 lb. structural and miscellaneous steel and iron to Panama. Imports for the week included 353 casks ferrosilicon from Rotterdam; 3808 tons pyrites from Huelva, Spain; 5650 tons manganese ore and 19,900 tons iron ore from Cuba.

Birmingham

Oct. 16—Southern furnace company officials are at sea as to the future iron market—there is no telling when an improvement is to set in. The fact that there is no accumulation of iron with the production heavy is a redeeming feature of the conditions. There is a fairly good movement of iron on old orders and the local melt is still good, the cast-iron pipe makers in particular using a large quantity of metal. The stove makers are still melting right along while general foundries and machine shops are using some iron. The iron prices are low, $10 @10.25 per ton, No. 2 foundry, being asked for the product. Some inquiries are reported for iron for delivery next year, but because of the low prices of iron no effort is being made by the manufacturers in this section of the country to book any of the business. The make in October will be as large, it is believed now, with half the month gone, as it was in September.

The steel situation shows no change. Reports from week to week are rather contradictory. All indications point to a continuation of operation at the steel plants in the South through the balance of the year at least. There is an exceptionally brisk demand for fabricated steel.

Chicago

Oct. 16—Aside from the very exceptional order of a lot occasionally between 1000 and 5000 tons in size, the pig-iron market is quiet and steady. The exceptional order shows nothing except that some one user of large amounts has at last come into the field; of general movement it typifies nothing. The great bulk of the trade remains in the foundry line and consists of purchases up to 1000 tons. Below 500 tons, indeed, is the common order yet, the tendency being to buy only as one must—as the needs of the trade actually in sight dictate.

Quotations on pig iron are but little changed. Southern No. 2 brings as a minimum $10, Birmingham, or $14.35, Chicago; Northern No. 2 is obtainable at $14.50 minimum, with 25@50c. more obtainable on lots for first-quarter and first-half deliveries under the most favorable terms to the consumer. The general tone is weak; there is no doubt about that. On the highly favorable contracts to the seller, the buyer may almost dictate his own terms.

In iron and steel products the market is weak to wobbly. No great strength obtains anywhere, though several lines, such as billets, structural material, plates and wire products record a fair to large volume of sales. Prices are cut, with the result that the market is uncertain on any large contract. Railroad supplies are in mild demand. Structural shapes find here and there a sale, but the total is small compared with the record of a few months ago. Steel bars continue to bring 1.33c. Chicago minimum, with much active competition and occasionally a sale at below the Pittsburg corresponding price, but in general a sticking to the standard price, and bar iron selling at 1.20c. minimum, local delivery. Sales of wire products continue large and stocks are small.

Cleveland

Oct. 20—Iron-ore shipments are slowing down, and a smaller movement is expected in October. Some vessels are preparing to lay up for the winter.

Pig Iron—Demand for basic iron seems to be improving, but foundry has been rather quiet. Quotations, Cleveland delivery, are $15.55 for bessemer, $13.75@14 for No. 2 foundry, $13 for gray forge and $17.50 for Lake Superior charcoal.

Finished Material—Several contracts for structural steel have been closed. There have been some sales of plates at 1.20c., but it is claimed that price can be shaded. Bars are rather quiet. A sale of reinforcing bars for concrete work is noted at 1.10c. at mill.

Philadelphia

Oct. 18—The multitude of recent inquiries for pig iron does not indicate as yet a genuine activity because of the limited sales recorded during the week. The slight concession in prices has rather discouraged buying. Stocks at eastern furnaces are rather low. Southern makers are not urgently seeking business in this territory. The principal sales this week are of high-grade foundry iron, at full quoted prices. Very little business is being done for next year's delivery. The heaviest crude-iron business has been in pipe iron and additional business is pending today. Southern makes have sold best chiefly because early deliveries can be made promptly. More malleable is selling and basic is under inquiry in large lots, one or two good sized lots having been already sold. Forge iron is dragging but a number of sales have been closed yesterday and today at about $14 though this price does not represent the best brand. Makers of basic are quite hopeful of closing big transactions in the neighborhood of $14.50. The general outlook is for moderate dealings until the demand for mill and foundry products has considerably improved.

Steel Billets—Unexpected orders were placed this week for both openhearth and forging billets by large consumers who were only recently in the market. Quotations $21.40 for rolling billets.

Bars—Bar mill reports show a moderate improvement in distribution of bars confined chiefly to common iron. In a retail way there are no shadings, but in large lots the market has followed the weakening influences apparent in the West. Refined bars 1.22½c.; steel bars 1.25c. tidewater.

Sheets—Sheets have improved considerably and several large consumers have been induced to arrange for remote deliveries at concessions which have made it an object.

Structural Material—The low quotations have brought out quite a lot of new business. It is recognized that quotations are now at rock bottom for sure and there is a general disposition to close up contracts.

Scrap—Scrap dealers report an exceptionally poor week.

Pittsburg

Oct. 17—There has been a slight increase in the turnover in steel products for the first half of October, as compared with either the second half or the first half of September, but the improvement is not general. In some products the movement is not as good, but on the whole the tonnage is increased rather than diminished. The iron industry is operating at a pace represented by 25,000,000 tons of pig iron a year, the steel interests making pig iron and shipping finished steel in proportion to the pig-iron make, while the foundries are drawing to a slight extent upon merchant-furnace stocks, and melting slightly more iron than the merchant furnaces are making, so that on the whole consumption is running a trifle ahead of production. The tonnage moving into actual consumption appears to be slightly larger than in September, and decidedly larger than in July and August.

As regards tonnage, the situation is fairly satisfactory. As regards prices it is entirely unsatisfactory, as prices are soft all along the line, with a definite decline every few days in one product or another. Monday, Oct. 16, the American Sheet and Tin Plate Company announced a reduction of 20c. a box in its price of tinplates, to $3.40, Pittsburg, for 100-lb. coke plates. There had been slight shading of the old price of $3.60, on odd lots for early delivery. The mills are now ready to book contracts over the first half of next year, and believe that with this rather radical reduction there will be no difficulty in holding the market. Pig tin is as high as in 1907, while tinplate is 45c. a box, or $9 a net ton lower, this fully taking up the decline which has occurred in sheet bars. The total decline in finished-steel products since the close of 1907 averages in excess of $10 per net ton or over $11 per gross ton.

Pig Iron—The market continues quiet, but prices are well maintained on the little business that is going in foundry iron, while nothing at all is being done in bessemer or basic. On ordinary lots foundry iron is held firmly at $13.50 at furnace, although one or two furnaces might shade this price on a round lot. The only transaction of any consequence reported in foundry iron in the past week was 500 tons, and it is believed the $13.50 price was shaded a trifle. Clinton furnace, Pittsburg, will blow in about Nov. 1. We quote, f.o.b. Valley furnaces, 90c. higher delivered Pittsburg: Bessemer, $14.50; basic, $12.50; No. 2 foundry, $13.50; forge, $13; malleable, $13 per ton.

Steel—Settlements for sheet-bar tonnages to be delivered this month have been effected, and most of the tonnage is going at $21, delivered Pittsburg or Youngstown. This is on bessemer, odd lots of openhearth bars being sold occasionally at concessions. Billets are nominally $20 for bessemer and $19 for openhearth, f.o.b. maker's mill, Pittsburg or Youngstown. Wire rods are quiet at $26, Pittsburg.

Ferromanganese—The market is without developments, a few odd lots for prompt shipment having lately gone at about $36.50, Baltimore, while the combination asks $38.50, Baltimore, for next year's deliveries. Freight to Pittsburg is $1.95 per ton.

Sheets—The market continues fairly active, with prices ragged but not quotably lower, at 1.85@1.90c. for black sheets, 2.85@2.90c. for galvanized and 1.40@1.45c. for blue annealed, 10 gage. Production is between 60 and 70 per cent. of the full capacity.

St. Louis

Oct. 16—There has been no change worth mentioning in the iron market this week. The volume of inquiries has been about fair, and mostly all for small lots. The tonnage on the whole is possibly a trifle more than last week. There seem to be fairly large buyers feeling the market for good-sized lots, though whether it will develop into business in the immediate future is hard to tell. The price on northern iron remains at $15@15.25 per ton, St. Louis, and on southern iron $10.25@10.50 per ton, Birmingham, or $14@14.25, St. Louis. There seems to be more demand for southern than for northern iron.

Iron Ore Trade

It is stated that the Canadian-American Ore Company organized in Montreal, has acquired possession of a large tract of iron-ore land on the Orinoco river in Venezuela, and has let contracts for machinery to be used in development. The company's engineers have made a thorough examination of the property.

Iron ore receipts at Lake Erie ports in September were 4,065,068 long tons, or 77.6 per cent. of the total shipments from the Lake Superior region. The heavier receipts were 1,246,181 tons at Conneaut, 1,065,020 at Ashtabula, 633,240 at Cleveland and 455,448 at Lorain.

Sault Ste. Marie Canal Traffic

Total freight passing through Sault Ste. Marie canals for the season to Sept. 1 was, in short tons:

	1910	1911	Changes
East-bound	30,657,557	21,100,586	D. 9,556,971
West-bound	9,389,243	10,387,737	I. 998,494
Total	40,046,800	31,488,323	D. 8,558,477

The total number of vessel passages this year was 11,174, showing an average cargo of 2818 tons. Mineral freights included in the totals were as follows, in short tons except salt, which is given in barrels:

	1910	1911	Changes
Coal	8,358,047	9,442,549	I. 1,084,512
Iron ore	28,055,531	18,695,862	D. 9,359,669
Pig and mfd. iron	266,658	260,774	D. 5,884
Copper	77,070	71,078	D. 5,992
Building stone	6,990	4,137	D. 2,853
Salt, bbl	397,367	382,826	D. 14,541

Iron ore was 59.4 per cent. of the total tonnage this year, and coal 29.7 per cent.

FOREIGN IRON TRADE

Iron and Steel—Exports and imports of iron and steel and of machinery in the United States for the eight months ended Aug. 31, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1910	1911	Changes
Exports	$130,148,034	$164,108,564	I. $33,960,530
Imports	27,759,334	20,226,510	D. 7,532,824
Excess, exp.	$102,388,700	$143,882,054	I. $41,493,354

Increase in exports, 26.1 per cent.; decrease in imports, 27.1 per cent. The leading items of iron and steel were, in long tons:

	Exports 1910	Exports 1911	Imports 1910	Imports 1911
Pig iron	70,865	85,368	159,947	107,999
Scrap	14,952	57,956	62,271	13,423
Billets, blooms, etc.	9,682	161,424	32,108	21,366
Bars	81,844	95,098	28,703	19,195
Rails	242,244	311,732	....	.....
Sheets and plates	179,563	219,220	4,761	1,549
Structural steel	104,219	142,173	.....	.....
Wire-rods	15,853	11,100	14,523	11,284
Wire	109,630	139,635	.....	.....
Nails and spikes	40,661	48,728	.....	.....
Tinplates	7,587	36,149	51,082	12,662
Pipe and fittings	105,141	130,177	.....	.....

Imports of wire not reported in quantities; values were $1,052,878 in 1910, and $930,929 in 1911. Imports of rails and structural steel not reported separately. Exports of mining machinery were valued at $4,224,124 in 1910, and $4,615,572 this year.

German Foreign Trade—Exports and imports of iron and steel and of machinery in Germany, six months ended June 30, metric tons:

	Exports	Imports	Excess
Iron and steel	2,475,395	298,510	Exp. 2,176,885
Machinery	214,373	41,218	Exp. 173,155
Total	2,689,768	339,728	Exp. 2,350,040
Total, 1910	2,555,150	302,718	Exp. 2,252,432

Imports of iron ore this year, 5,095,876 tons; exports, 1,292,841 tons. Imports of manganese ore, 210,470; exports, 2537 tons.

METAL MARKETS

New York, Oct. 18—The metal markets have been rather irregular during the week. Spelter continues strong for early deliveries, while some activity in copper for October deliveries has also developed.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Aug. 1911	$ 480,799	$ 4,105,331	Imp. $ 3,624,532
" 1910	3,150,423	12,818,606	Exp. 9,668,183
Year 1911	15,910,449	40,473,010	Imp. 24,562,561
" 1910	53,495,605	42,489,786	Exp. 11,005,819
Silver:			
Aug. 1911	4,869,359	3,653,329	Exp. 1,216,030
" 1910	4,755,708	4,119,362	Exp. 636,346
Year 1911	44,587,570	29,534,724	Exp. 15,052,846
" 1910	36,934,397	29,815,770	Exp. 7,118,627

Exports from the port of New York, week ended Oct. 14: Gold, $39,770; silver, $828,152, chiefly to London and Paris. Imports: Gold, $130,554; silver, $130,210, principally from Mexico and South America.

Gold—Prices on the open market in London were unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. There was some demand for gold for Paris and Berlin, but not sufficient to induce any offers of premiums.

Platinum—The market continues firm, and there is no change in prices. Dealers ask $46@46.50 per oz. for refined platinum and $48.50@49 per oz. for hard metal. The market abroad is strong.

Iridium—This metal continues rather scarce and prices are firm at $65 per oz. for pure metal.

Silver—The market shows an upward movement, but whether the rise is to be small does not yet indicate itself. China seems to be the support at present, and the price has advanced ¼d. in London at this writing.

SILVER AND STERLING EXCHANGE

Oct.	12	13	14	16	17	18
New York	....	52⅛	52⅛	52⅝	52⅞	53⅛
London	24 5/16	24⅛	24⅛	24⅛	24⅜	24⅛
Sterling Ex.	....	4.8630	4.8635	4.8650	4.8660	4.8660

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Shipments of silver from London to the East, Jan. 1 to Oct. 5, reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£5,253,500	£6,402,000	I. £1,148,500
China	1,118,500	989,700	D. 128,800
Total	£6,372,000	£7,391,700	I. £1,019,700

Average price of India Council bills in London for the week, 16.06d. per rupee.

Copper, Tin, Lead and Zinc

NEW YORK

Oct.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
12	.....	.....	....	.....	4.10 @4.12½	.....	5.90 @6.00
13	12⅛ @12¾	12.10 @12.15	40½	4.20 @4.25	4.10 @4.12½	6.05 @6.15	5.90 @6.00
14	12⅛ @12¾	12.10 @12.15	40⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.20	5.95 @6.05
16	12⅛ @12¾	12.15 @12.20	41⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10
17	12¼ @12½	12.15 @12.25	41⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10
18	12¼ @12½	12.15 @12.25	41⅛	4.20 @4.25	4.10 @4.12½	6.10 @6.25	5.95 @6.10

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—There has been a decided improvement in sentiment this week, which finds its basis in a material increase in the demand from Europe. It has been reported that the recent decrease in exports does in no way reflect a lessening in the consumption of copper on the other side but is altogether due to an inclination on the part of consumers to allow their stocks to run down to a minimum, which has been the practice among the domestic buyers for so many months past. However, such tactics cannot be continued for any length of time by the foreigners, on account of the distance of their largest source of supply, and an active export business is therefore the result. After making liberal sales during the early part of the week, the various

LONDON

Oct.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
12	54⅝	55 7/16	58⅛	182¼	183¼	15 3/16	27⅜
13	54⅞	55 11/16	58¾	183⅞	183¾	15⅛	27⅝
14	.....	.....	.....	.....	.....	.....	.....
16	55 3/16	56	59	189¾	189	15⅛	27⅝
17	55	55 11/16	59	188⅝	188	15 3/16	27½
18	55⅜	56 3/16	59¼	189	188⅝	15¼	27½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.40c. ± £1 = ± 0.21¾c.

sellers were able to raise their prices, and the close is higher and firm at 12¼ @12½c. for Lake copper, and 12.15@ 12.25c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12@12⅛ cents.

The standard market has been stimulated by the consumers' business, advancing from day to day, and closing strong at £55 7s. 6d. for spot, and £56 3s. 9d. for three months.

Visible stocks of copper in Europe Oct. 16 are reported as follows: In Great Britain, 49,890 long tons; in France, 5850; afloat from Chile, 2180; afloat from Australia, 6500; in Rotterdam, 7200; in Hamburg, 10.700; total, 82,320 long tons. This is a decrease of 2376 tons, as compared with the Sept. 30 report.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire has been reduced to 13½c. base, carload lots at mill. Business is quiet.

Tin—After a break of over £4 in the quotation on Oct. 12, the market, just as suddenly, advanced about £6 on Oct. 16. These fluctuations were ascribed to manipulation on part of the Syndicate, which, while freely swapping spot for three months' tin on one day, refused to do so on the next, thereby bringing about a covering movement by shorts, with the result of a violent advance in prices. The statistical position of the metal continues to be a favorable one, and the intrinsic strength of the market is also manifested by the quotation for three months' tin, which is now almost on a parity with spot. The close is firm at £189 for spot, and £188 12s. 6d. for three months.

A great deal of profit taking was indulged in by dealers in this market, and sales were made at below the cost of imports from London. Since the beginning of the week, a change of front is noticeable, sellers having almost entirely withdrawn. October tin is quoted at about 41⅝ cents.

Messrs. Robertson & Bense report the arrivals of tin ore at Hamburg, Germany, in September at 2022 tons; 1991 tons being from Bolivia and 32 tons from South Africa.

Lead—The impression is gaining ground that the lead market for the time being has seen bottom and this has helped the situation in the West. Prices at St. Louis are higher at 4.10@4.12½c., and unchanged at New York at 4.20@ 4.25 cents.

The lead market in London is holding firm, with Spanish lead at £15 5s., and English lead at £15 7s. 6d. per ton.

Spelter—The great scarcity of near-by supplies is still making it difficult to gage the market for the deliveries for which business is being done on a larger scale, sellers being quite willing to accept considerably below current quotations against the large stocks of ore which have accumulated at all zinc works. The close is firm at 6.10@6.25c., New York, and 5.95@6.10c., St. Louis.

The London market is slightly softer, quotations being cabled at £27 10s. for good ordinaries, and £27 15s. for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Silesian Zinc Market—Paul Speier reports from Breslau, Germany, under date of Sept. 28, that the market is strong and advancing; the current quotation is 55.25 m. per 100 kg.—equal to 5.96c. per lb.—for good ordinary brands and 56.25 m. for specials, f.o.b. works in Silecia. November deliveries are quoted 55.50 and December 55.75 m. Zinc sheets are unchanged. Zinc dust quoted at 52.50@54 m. per 100 kg.—average 5.8c. per lb.—f.o.b. works.

Other Metals

Aluminum—Only a moderate business is being done at unchanged prices. We quote 18½@19c. per lb. for No. 1 ingots, New York.

Antimony—Business is still dull and the range of prices is again lower. Cookson's is quoted at 8@8.12½c. per lb., and Hallett's at 7.60@7.75c. Outside brands have been offered at low prices, and we quote 6.85@7c. for Hungarian, Chinese and other brands.

Quicksilver—Business is rather slow, but prices are unchanged. New York quotation is $45 per flask of 75 lb., with the usual advance for small quantities. San Francisco, $44.50 for domestic orders and $42 for export. London price is £8 10s. per flask, with £8 7s. 6d. quoted by second hands.

Imports and Exports of Metals

Exports and imports of metals in the United States, eight months ended Aug. 31, are reported as follows, in the measures usual in the trade:

Metals	Exports	Imports	Excess
Copper, long tons	237,202	100,923	Exp. 136,279
Copper, 1910....	184,952	98,213	Exp. 86,739
Tin, long tons....	863	32,283	Imp. 31,420
Tin, 1910.....	424	32,606	Imp. 32,182
Lead, short tons.	70,366	60,656	Exp. 9,710
Lead, 1910.....	40,162	71,116	Imp. 30,954
Spelter, sh. tons.	4,244	1,303	Exp. 2,941
Spelter, 1910....	1,108	2,549	Imp. 1,441
Nickel, lb.....	16,078,387	19,951,900	Imp. 3,873,513
Nickel, 1910....	8,905,516	21,373,709	Imp.12,468,193
Antimony, lb.....	160,844	6,982,003	Imp. 6,821,159
Antimony, 1910.	2,726	6,576,328	Imp. 6,573,602
Platinum, oz.....	95	77,505	Imp. 77,410
Platinum, 1910.	47	78,006	Imp. 77,959
Aluminum, value	$851,436	.....	Exp. $851,436
Aluminum, 1910	524,382	.....	Exp. 524,382
Ores, etc.			
Zinc oxide, lb. .	18,105,764	.....	Exp.18,105,764
Zinc oxide, '10..	17,280,303	.....	Exp.17,280,303
Zinc dross, lb....	5,608,110	.....	Exp. 5,608,110
Zinc dross, '10..	6,703,070	.....	Exp. 6,703,070
Zinc ores, lg.tons	13,277	35,142	Imp. 21,865
Zinc ores, 1910.	12,519	42,432	Imp. 29,913
Chrome ore, tons	5	27,568	Imp. 27,563
Chrome ore, '10	30	27,850	Imp. 27,820

Copper, lead, nickel and antimony include the metal contents of ores, matte, bullion, etc. Quantity of antimony ore is not reported. Imports of aluminum for July and August, 1911, were 656,624 lb.; not reported previous to July 1, 1911. The metal exports given above include reëxports of foreign material. Zinc contents of ore imported were 32,883,952 lb. in 1910, and 22,844,827 lb. in 1911. There were reëxported foreign ores containing 5,817,154 lb. metal in 1910, and 14,624,226 lb. this year; leaving net imports of zinc in ore 27,066,798 lb. in 1910, and 8,220,601 lb. this year.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 14—The base price paid this week for 60 per cent. zinc ore was $43.50. The base price paid for 80 per cent. lead ore was $51 per ton.

SHIPMENTS, WEEK ENDED OCT. 14

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point.....	719,100	.....	.....
Platteville.....	615,580	.....	368,920
Galena.....	410,800	.....	.....
Hazel Green.....	352,000	.....	.....
Benton.....	331,770	55,300	.....
Highland.....	244,000	.....	.....
Shullsburg.....	78,000	.....	.....
Cuba City.....	62,000	.....	.....
Harker.....	61,550	.....	.....
Total.....	2,874,800	55,300	368,920
Year to date.....	119,821,769	7,313,485	24,133,000

Shipped during week to separating plants, 3,937,090 lb. zinc ore.

Joplin, Mo., Oct. 14—The high price of zinc sulphide ore was $47, the base ranging, per ton of 60 per cent. zinc, from $39 to $44. Zinc silicate ore sold on a base, per ton of 40 per cent. zinc, of $24 @25. The average price, all grades of zinc, was $40.28. A rumored $57 for lead ore lacks confirmation, the highest offering of the week being $55, with purchases as low as $52 for a few small lots. The average price, all grades of lead ore, was $54.66 per ton.

The American, Zinc, Lead and Smelting Company came into the market this week for a large shipment of ore from its mines and from the companies with which it holds contracts. Over 20 carloads were

embraced in the total consignment. Until Friday morning bidding was slow at a high offering of $44, and, while no higher price offering was made the last two days for the choicest grades, the largely increased demand for medium grades brought a firmer market all along, the evident strength of spelter proving an added stimulant. Large purchases were made at the week-end for next week's shipment.

SHIPMENTS, WEEK ENDED OCT. 14

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,146,140	.....	1,007,020	$112,687
Joplin	2,664,290	.....	268,650	63,333
Alba-Neck	904,950	.....	15,000	20,313
Oronogo	512,930	.....	119,740	12,483
Miami	410,910	.....	151,450	10,665
Carl Junction	461,640	.....	.....	10,600
Galena	352,810	.....	96,160	9,650
Duenweg	321,020	64,610	12,620	7,824
Granby	92,030	273,050	13,180	5,850
Spurgeon	70,120	206,310	34,020	5,405
Quapaw	65,530	.....	50,000	3,695
Aurora	63,000	143,000	.....	3,320
Jackson	147,570	.....	.....	2,950
Cave Springs	64,890	.....	.....	1,425
Wentworth	63,120	.....	.....	1,262
Totals	10,340,950	686,970	1,767,820	$270,462
41 weeks	388,029,730	28,458,830	70,269,410	$10,298,945
Blende val., the week, $212,329; 41 weeks, $7,753,071				
Calamine, the week, 9,794; 41 weeks, 444,580				
Lead value, the week, 48,339; 41 weeks, $2,001,294				

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, Oct. 18—The general markets continue to show some improvement, but without marked activity in any special direction.

Copper Sulphate—Prices are unchanged at $4.50 per 100 lb. for carload lots, and $4.75 per 100 lb. for smaller orders. Business is fair.

Arsenic—This article continues firm, although no new offers have been made. The prices hold at $2@2.12½ per 100 lb. for white arsenic for early delivery.

Nitrate of Soda—Business continues good and prices remain as last reported—2.22½c. per lb. for spot and for deliveries up to April; and 2.20c. per lb. for deliveries beyond April 1 next.

Petroleum

Petroleum production in the eastern fields—including New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky—in September is reported by the Oil City *Derrick* at 2,133,341 bbl., stocks at 15,300,054 bbl. on Sept. 30. Illinois production for September was 2,179,591 bbl.; shipments, 1,252,988 bbl.; stocks, 21,904,719 bbl. at close of the month.

Production of Baku field in Russia, eight months ended Aug. 31, was 4,700,688 metric tons of crude petroleum; a decrease of 659,832 tons from last year.

The Oil City *Derrick* reports the number of new producing wells in September as follows: Pennsylvania, New York and West Virginia, 411; Lima-Indiana, 58; Kentucky, 9; Illinois, 138; Kansas-Oklahoma, 347; Louisiana-Texas, 67; total, 1030.

MINING STOCKS $

New York, Oct. 18—The general stock market has been one of comparatively small fluctuations, with alternate advances and declines in quotations. There have been a few exceptions in special cases, where good gains were recorded. The market apparently has no definite tendency, and feels the absence of any directing influence.

Trading in mining stocks on the Curb was generally in small volume, and fluctuations were small. The copper stocks were inclined to weakness, but within narrow limits. The Cobalt stocks were not active and there were only moderate sales of Porcupine.

Boston, Oct. 17—The week has shown a firm tone to the copper-share market, but it lacked animation, except in a few specialties. Arizona Commercial varied from 33 to 60c. and closed around 40c. The plan for consolidation with the Superior & Boston has been abandoned because of the failure of holders to deposit the necessary 75 per cent. of Arizona Commercial bonds. This puts the present bondholders and stockholders in charge and an assessment on the stock of $3 or more.

The Winona Copper Company has called a $1 assessment, payable Nov. 10. With this payment a total of $23 per share will have been paid in. This caused a fractional decline in Winona shares. Mayflower is selling at $1.50, with a $1 assessment paid. Utah Consolidated has maintained a strong tone since the 50c. dividend declaration and touched $17, an advance of $2.87½ during the week. It is now anticipated that another 50c. dividend will be declared before the annual meeting next April. Granby is up $3.25 to 30.25 on small buying. No news accompanied the advance. Indiana broke $1.62½ to $5.37½ on the calling of a $1 assessment, payable Nov. 1. This makes a total of $9.50 paid in to date.

Activity in the Calumet & Hecla group subsided after a day or two of animation. As a rule these stocks have sought lower levels from the recent highs. It is felt that market conditions are improved, however, by the abandonment of this merger as it releases six or seven active

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company	July	August	Sept.
Alaska shipments	4,678,637	.....	.....
Anaconda	21,900,000	22,500,000	21,565,800
Arizona, Ltd	2,750,000	2,720,000	2,544,000
Balaklala	.....	.....	.....
Copper Queen	6,373,062	7,006,097	6,546,540
Calumet & Ariz	4,394,000	4,650,000	4,198,000
Detroit	1,590,357	2,080,100	1,864,050
East Butte	847,000	854,000	1,134,000
Mammoth	1,598,082	.....	.....
Nevada Con	5,258,582	5,249,515	.....
Old Dominion	2,114,000	1,982,000	2,032,000
Shannon	1,150,000	1,442,560	1,550,080
South Utah	254,462	269,546	.....
United Verde*	3,000,000	2,500,000	.....
Utah Copper Co	7,555,407	9,010,669	.....
Lake Superior*	17,060,000	19,000,000	.....
Non-rep. mines*	16,800,000	.....	.....
Total production	97,263,589	.....	.....
Imports, bars, etc.	20,999,078	22,798,151	.....
Total blister	118,362,667	.....	.....
Imp. in ore & matte	4,205,940	9,821,942	.....
Total	122,568,607	.....	.....
Brit. Col. Cos.:			
British Col. Copper	854,122	.....	.....
Granby	1,228,846	.....	.....
Mexican Cos.:			
Boleo	1,973,680	2,149,028	2,094,400
Cananea	3,994,000	.....	.....
Moctezuma	2,340,404	2,263,707	2,112,683
Other Foreign:			
Cape Cop., S. Africa	.....	.....	.....
Spassky, Russia	672,000	649,600	.....
Exports from:			
Chile	7,168,000	4,032,000	.....
Australia	7,056,000	7,392,000	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export
IX, 1910	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424 316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,936,364	69,855,660
IX	115,588,950	57,311,584	50,824,011

	Visible Stocks.		
	United States.	Europe.	Total.
X, 1910	148,793,714	211,276,800	360,070,519
XI	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,095
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

stocks that have been under the ban for the last ten months.

Curb trading has been of fair proportions with a generally steady list of prices. The Porcupine stocks have been notably strong and active.

Assessments

Company	Delinq	Sale	Amt
Andes, Nev.	Nov. 2	Nov. 28	$0.05
Cœur d'Alene, Ida.	Oct. 16	Nov. 10	0.003
Con. Imperial, Nev.	Oct. 10	Oct. 31	0.01
Copper Chief, Ida.	Oct. 18	Nov. 3	0.002½
Copper Mountain, Ida.	Nov. 1	Dec. 1	0.002
Gould & Curry, Nev.	Oct. 23	Nov. 15	0.05
Highland, Utah.	Oct. 25	Nov. 25	0.01
Mayflower, Mich.	Oct. 16	.....	1.00
Montana-Bingham, Utah.	Oct. 20	Nov. 10	0 01
Mountain Dell, Utah.	Oct. 24	Nov. 14	0 01
New York-Bonanza, Utah.	Sept. 8	.....	0.02
Savanna, N. M.	Nov. 1	.....	5.00
Seg. Belcher, Nev.	Nov. 2	Nov. 27	0.05
Seven Troughs, Nev.	Oct. 20	Nov. 20	0.002
Sheridan, Ida.	Oct. 20	Nov. 20	0.001
Sierra Nevada, Nev.	Oct. 28	Nov. 21	0.10
Springfield, Ida.	Sept. 2	Oct. 2	0.000½
Springville, Ida.	Oct. 20	Nov. 20	0.002
Superior & Boston, Ariz.	Oct. 16	.....	0.50
Swansea, Utah.	Nov. 13	.....	0.01
Torino, Ida.	Oct. 27	Nov. 27	0.001
Treasure, Cal.	Oct. 12	Nov. 4	0.05
Utah United Utah.	Oct. 19	Nov. 4	0.01
Victoria, Mich.	Aug. 21	.....	1.00
Winona, Mich.	Nov. 10	.....	1.00
Wonderful, Ida.	Oct. 30	Nov. 18	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24 865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52 745	23.227	23.690	24.324
April	51.428	53.221	53 325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52 630	23.519	25 034	24 286
August	51.125	52.912	52 171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25 680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12 680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12 214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12 720	54.194	56.670
August	12.490	12 405	12.715	12 634	55.733	56.264
September	12.379	12.201	12 668	12.508	55.207	55.253
October	12.553	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57 634	.....
December	12 581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43 319
March	32.403	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	.....
May	33.125	43.115	November	36.547	.....
June	32.769	44.606	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Mohth	New York		St. Louis		London	
	1910.	1911	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4 500	4.290	4.406	12.513	14.026
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911,	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5 041	5.198	22.100	24.375
June	5.128	5.520	4.978	5 370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5 953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	.....	5.478	.....	23.900	.....
November	5 976	.....	5.826	.....	24 083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23 050	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15 90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14 00	15.16	14 47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14 26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	$17.10	.....	$15.65	.....	$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS Oct. 17

Name of Comp.	Bid.
Acacia	.02¾
Cripple Cr'k Con.	.02½
C. K. & N.	.10
Doctor Jack Pot	.05
Elkton Con.	.62
El Paso	.53½
Findlay	.05
Gold Dollar	.14
Gold Sovereign	.02½
Isabella	.08½
Jack Pot	.05
Jennie Sample	.05
Lexington	‡.01
Moon Anchor	‡.01½
Old Gold	.03½
Mary McKinney	.43
Pharmacist	‡.02
Portland	.87
Vindicator	.66⅞
Work	.01

SALT LAKE Oct. 17

Name of Comp.	Bid.
Beck Tunnel	.15
Black Jack	.09
Carisa	.16
Cedar Talisman	.02½
Colorado Mining	.30
Columbus Con	.28
Daly Judge	‡4.12½
Grand Central	1.00
Iron Blossom	1.02½
Little Bell	.40
Lower Mammoth	.02½
Mason Valley	7.50
May Day	.11
Nevada Hills	2.82½
New York	‡.05½
Prince Con	.60
Silver King Coal'n	1.17½
Sioux Con	.15
Uncle Sam	.29
Yankee	‡ 15½

TORONTO Oct. 17

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.25	Pearl Lake	.41½
Hudson Bay	70.00	Porcu. Gold	.42
Temiskaming	.38	Porcu. Tisdale	.06
Wettlaufer-Lor	.77	Preston E. D.	.29½
Apex	.16	West Dome	1.10
Central	3.20	Standard	.18½
Dobie	1.45	Foley O'Brien	.70
Dome Exten	.74	Rea	2.60
Hollinger	11.75	Coronation	.04
Imperial	.10	Swastika	.35

SAN FRANCISCO Oct. 17

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.04	Belmont	8.52½
Belcher	.55	Jim Butler	.20
Best & Belcher	.17	MacNamara	.24
Caledonia	.90	Midway	.28
Challenge Con	.19	Mont.-Tonopah	.81
Chollar	.13	North Star	.20
Confidence	.50	West End Con	.77
Con. Virginia	.83	Atlanta	.17
Crown Point	.10	Booth	.08
Gould & Curry	.11	C.O.D. Con	.07
Hale & Norcross	.20	Comb. Frac	.08
Mexican	3.65	Jumbo Extension	.21
Occidental	.50	Oro	.04
Ophir	1.90	Silver Pick	.07
Overman	.89	St. Ives	.35
Potosi	.26	Tramps Con	.03
Savage	.22	Argonaut	‡2.50
Sierra Nevada	.34	Bunker Hill	‡6.50
Union Con	1.20	Cent. Eureka	.79
Yellow Jacket	.38	So. Eureka	‡6.00

N. Y. EXCH. Oct. 17

Name of Comp.	Clg.
Amalgamated	51⅞
Am. Agri. Chem.	50½
Am.Sm.&Ref.,com	65¾
Am. Sm.& Ref., pf.	102
Anaconda	33⅜
Batopilas Min	1⅞
BethlehemSteel pf	56
Chino	19¾
Comstock Tunnel	‡.17
Federal M.& S., pf.	50
Goldfield Con	4
Great Nor., ore ctf.	50
Homestake	83
Miami Copper	19
Nat'nalLead,com.	48
National Lead, pf.	106
Nev. Consol	15⅞
Pittsburg Coal, pf.	‡80
Ray Con	13¾
RepublicI&S,com	22½
Republic I & S, pf.	84
SlossSheffi'd,com.	40
Sloss Sheffield, pf.	‡110¼
Tennessee Copper	35½
Utah Copper	42½
U. S. Steel, com.	59¾
U. S. Steel, pf.	109¾
Va. Car. Chem.	48⅝

N. Y. CURB Oct. 17

Name of Comp.	Clg.
Barnes King	.25
Beaver Con	50
Braden Copper	4¾
B. C. Copper	3¾
Buffalo Mines	1.40
Butte & Vipond	.52
Butte Coalition	15
Cobalt Central	‡.00½
Con. Ariz. Sm.	⅜
Davis-Daly	⅞
Ely Con.	1/16
Florence	1/16
Giroux	3 1/16
Gold Hill Con.	⅜
Greene Cananea	5⅞
Greenwater	.05
Guanajuato	‡3¾
Guerrero	‡1¼
Guggen. Exp.	170
Inspiration	7⅛
Internat. S. & R.	‡124
Kerr Lake	3 1/16
La Rose	3⅞
McKinley-Dar-Sa.	1 1/16
Min. Co. of A. new	4⅞
Nev. Utah M. & S.	1/16
Nipissing Mines	7⅝
Ohio Copper	1⅞
Pacific Sm. & M.	1/16
Precious Metals	‡1⅜
Ray Central	1⅛
Red Warrior	‡1⅛
South Utah M. & S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	340
Stand'd Oil Subs.	325
Stewart	.82
Tonopah	7
Tonopah Ex	.90
Tri-Bullion	1/16
Tularosa	‡⅞
Union Mines	1/16
Yukon Gold	3 1/16

LONDON Oct. 18

Name of Com.	Clg.
Camp Bird	£1 8s 3d
Dolores	1 10 0
El Oro	1 3 3
Esperanza	1 13 1½
Mexico Mines	6 13 9
Oroville	0 5 0
Stratton'sInd.	0 2 0
Tomboy	1 0 0

BOSTON EXCH. Oct. 17

Name of Comp.	Clg.
Adventure	4¼
Algomah	2½
Allouez	27
Am. Zinc	21¼
Arcadian	2
Arizona Com.	40
Atlantic	‡6
Bonanza	.60
Boston & Corbin	.04½
Butte & Balak.	3¾
Calumet & Ariz.	48
Calumet & Hecla.	380
Centennial	9
Con. Mercur	‡.04
Copper Range	52⅛
Daly-West	5
East Butte	10¼
Franklin	6½
Granby	30
Hancock	19
Hedley Gold	‡14⅛
Helvetia	87
Indiana	5½
Isle Royale	13¾
Keweenaw	1⅞
Lake	24½
La Salle	4¾
Live Oak	21
Mass	5¼
Michigan	1
Mohawk	39
New Arcadian	‡21¼
North Butte	24½
North Lake	4
Ojibway	4½
Old Dominion	37
Osceola	86
Parrot	8¾
Quincy	58
Shannon	7¼
Shattuck-Ariz.	‡16
Superior	24¾
Superior & Bost.	2½
Tamarack	22
Trinity	3
Tuolumne	3½
U. S. Smelting	32
U. S. Smelt'g, pf.	46
Utah Apex	2⅛
Utah Con	16¼
Victoria	1⅝
Winona	4
Wolverine	89
Wyandot	‡90

BOSTON CURB Oct. 17

Name of Comp.	Last
Ahmeek	165
Bingham Mines	1
Boston Ely	.85
Boswyocolo	.11
Cactus	.16
Calaveras	.80
United Verde Ext.	.70
Chief Cons	.65
Corbin	1 1/16
Cortez	1½
Crown Reserve	2½
First Nat. Cop.	1
Majestic	.34
Mazatan	‡.35
Moneta Porc.	‡.12
Nat'l Mine & Ex.	.05
Nevada-Douglas.	2¾
New Baltic	3½
Oneco	1½
Raven Copper	.22
Rhode Island Coal	1⅞
San Antonio	‡3½
South Lake	3¾
Trethewey	‡.65
United Zinc, pfd.	‡2
Vulture	5
Yuma	‡.02

‡Last quotation.